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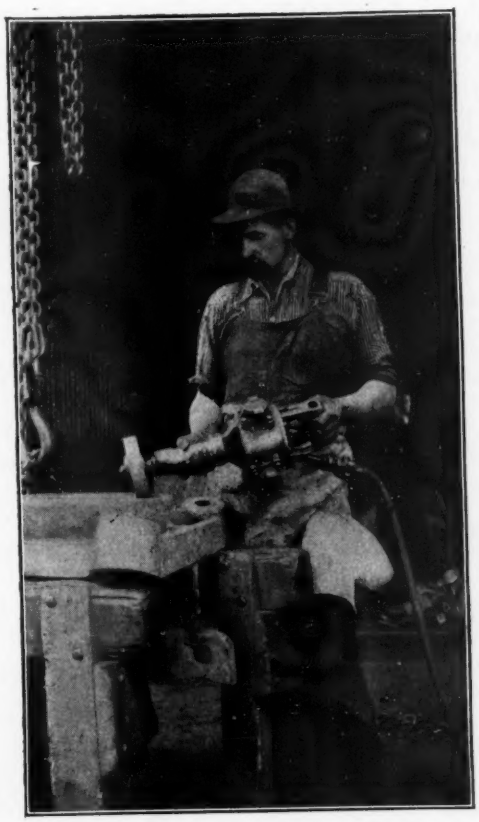
Vol. XXII FEBRUARY, 1917. No. 2



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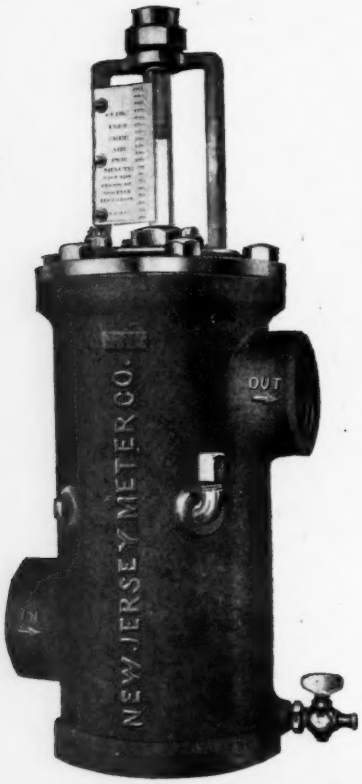

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EVERYTHING PNEUMATIC.

Vol. XXII. FEBRUARY, 1917 No. 2

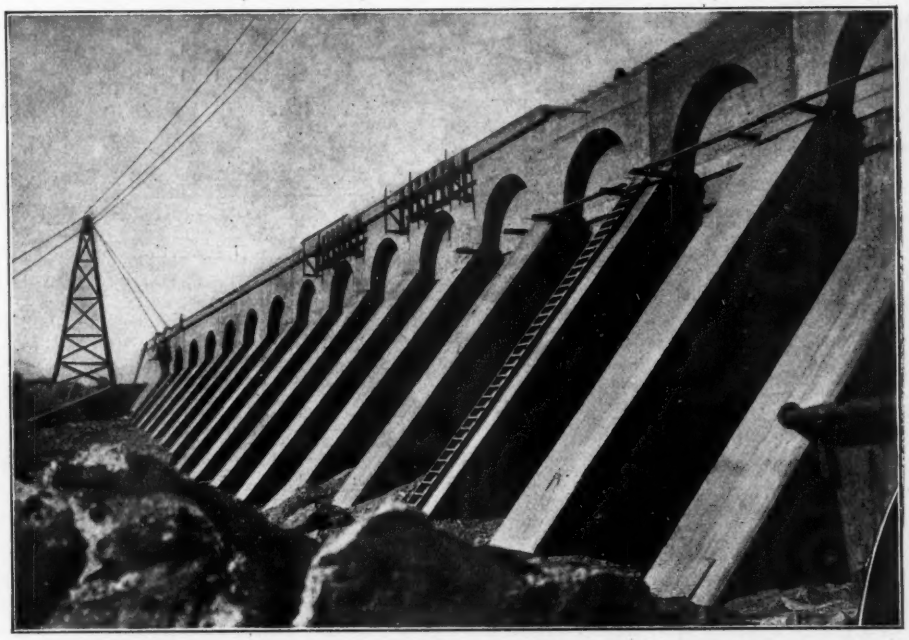


FIG. 1

TRAP FALLS RESERVOIR ENLARGEMENT INVOLVING THE RECONSTRUCTION OF A DAM

BY CHAS. A. HIRSCHBERG

The growth of the city of Bridgeport, Conn., both commercially and in point of population, has been very marked during the past five years. In anticipation of a continuance of this growth, the Bridgeport Hydraulic Co., which supplies the city of Bridgeport with its water, has had under way various plans for an increased water supply.

The following is a description of work for the enlargement of Trap Falls Reservoir, one of the five links in a water supply system admitted to be most ample and satisfactory, especially when compared with the water supply systems of many cities of equal or even greater population.

The Trap Falls Reservoir lies in a natural basin approximately 8 miles above the city of Bridgeport, and before reconstruction covered an area of about 240 acres, closed at its outlet by a concrete dam of mass structure

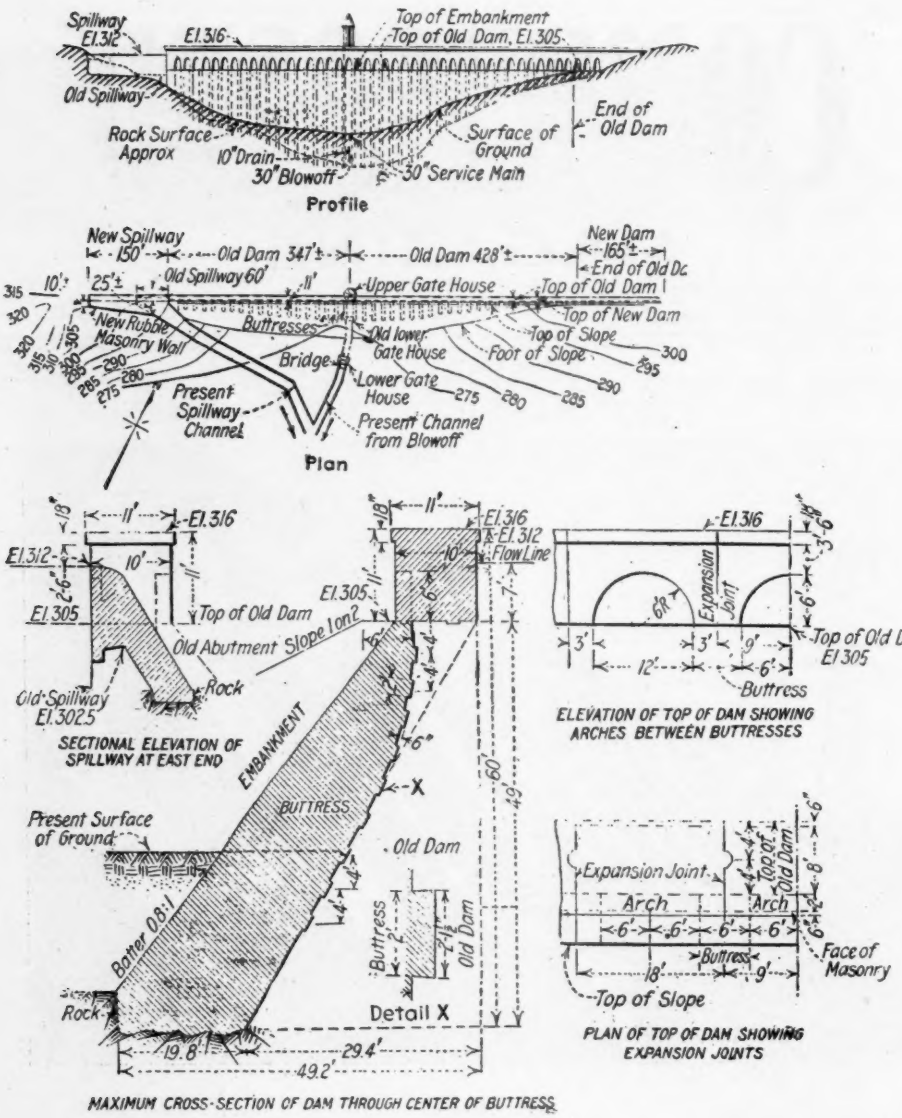


FIG. 2.

built some 11 years ago, prior to the days of reinforced concrete engineering. The water is piped to the reservoir through 3 miles of 30 in. mains from the Far Mills River, which has a drainage area of about 7 square miles; also through 4 miles of 36 in. pipe from Mean's Brook, drainage area 8 square miles; total, 15 square miles.

The capacity of the reservoir before reconstruction was 1,400 million gallons, over 50% below the capacity for supply of the drainage area. The problem, therefore, involved the provision for larger storage capacity.

To avoid extended stoppage of the water supply from this reservoir, the company's engineers decided upon the reconstruction of the old dam, in accordance with the plan shown in Fig. 2. It is interesting to note that the work progressed without in any way interfering with the water supply except for a period

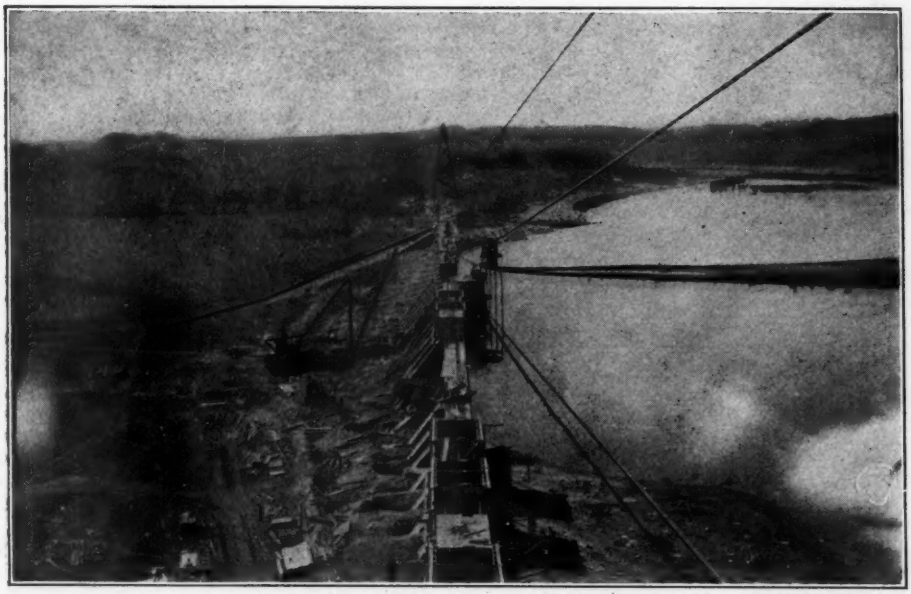


FIG. 3.

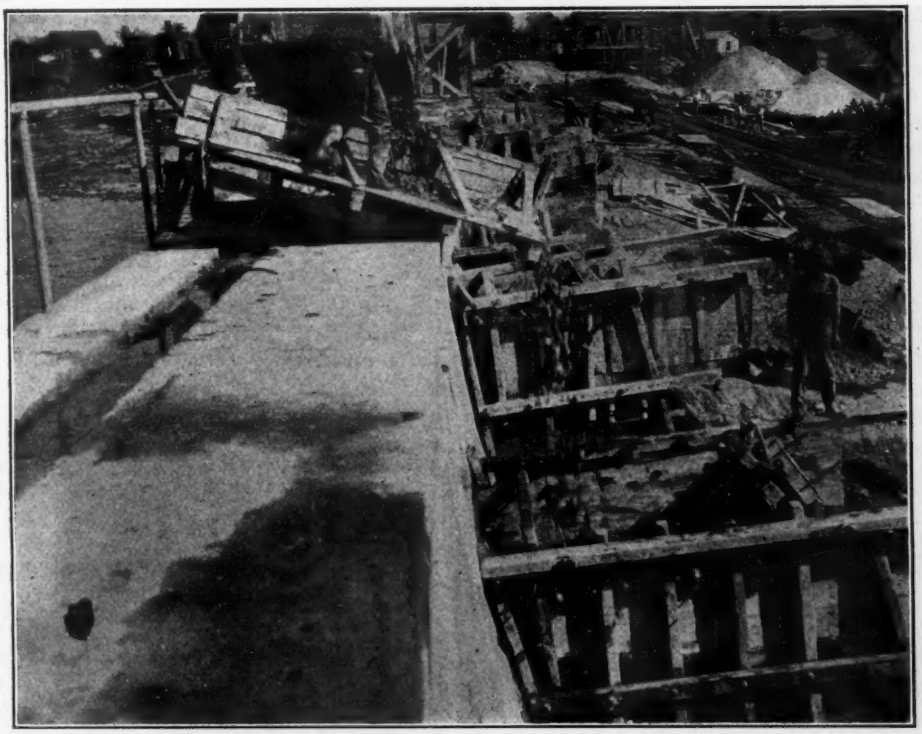


FIG. 4.

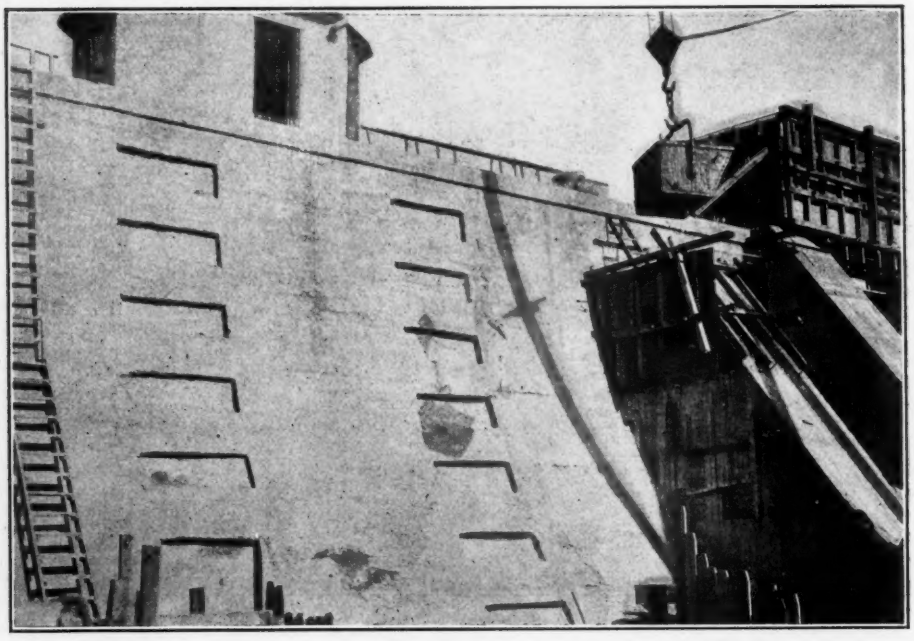


FIG. 5.

of one week during the placing of the concrete buttresses in the immediate vicinity of the service main.

A comparison of the old and the new dam structures, shown in Fig. 2, shows that it meant an increase in height of 11 ft. and an increased length of 225 ft.

The surface area of the reservoir is increased from 240 to 300 acres and it will have a capacity for 2,200 million gallons. It will be noted that the mean high water level of the old reservoir was 302 ft. as against 312 ft. for the new.

As already stated, the old structure was of mass concrete. No provision whatever had been made for expansion, and as a result the dam had developed cracks with slight leaks. In the reconstruction this has been provided for in a unique manner. Blocks of concrete 11 ft. high, 18 ft. long and 10 ft. wide were placed alternately 18 ft. apart and permitted to harden thoroughly before the intermediate blocks were poured. These blocks were joined to the old structure by means of a channel or key-way 18 in. wide and 4 in. deep, cut along the full length of the top of the old dam. This is shown in Fig. 4.

FIG. 6.

The increase in height made it desirable to brace the structure to take care of increased stresses. For this purpose 46 buttresses, as shown in Figs. 1 and 2 were provided. These buttresses are 6 ft. wide placed on 18 ft. centers and connected at the top by arches. These arches also support the overhang of the concrete blocks placed at the top of the dam.

The greatest problem presented in this work was perhaps that of tieing up the new additions to the old structure. In Fig. 5 is shown the method adopted to key the buttresses. So that they could take the thrust, mortise and tenon joints 6 ft. long by 4 ft. wide and 6 in. deep were made 4 ft. 6 in. apart on a vertical plane in the face of the dam.

DRILLING AND CUTTING THE MORTISES AND CHANNELS

The channel in the top of the dam and the mortises in the face were cut by drilling, broaching and picking, employing three Jackhamer Drills and three Little David Pneumatic Picks as follows:

Holes were drilled with a 1½ in. cross bit,

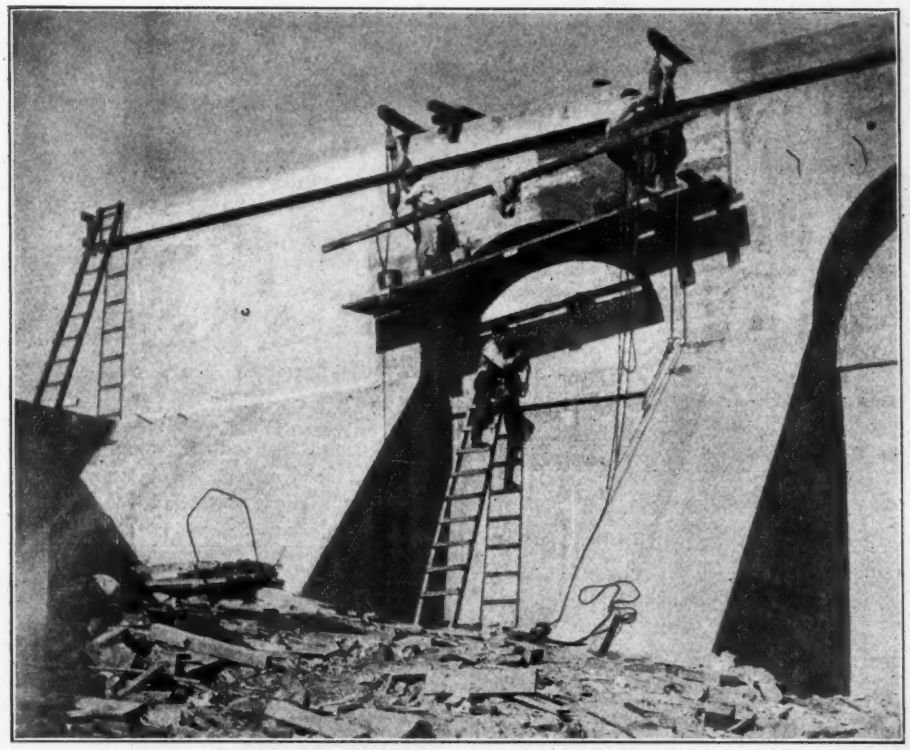


FIG. 7.

approximately 1 in. apart both along and across the channel to a depth of 4 in. This was followed by pneumatic picks employing a special broaching tool, as shown in Fig. 6, along the outside edge of the channel, breaking down the intervening concrete to form a continuous groove. An ordinary pointed pick was then inserted in the pneumatic hammer and the drilled concrete chipped out.

Holes 6 in. deep were drilled with Jackhamers as closely together as they could be gotten with a 1½ in. cross bit. The men operating the Jackhamers worked from suspended platforms, as shown in Fig. 3. The concrete between the holes along the edge of the intended mortise was then broached by the flat tool already referred to, and the remaining concrete picked out by the pointed pick operated by a pneumatic hammer.

In drilling these mortises the Jackhamers were supported in special hangers suspended from 2½ in. air pipe strung along the face of the dam. One man and a Jackhamer drilled and broached one complete mortise in 4½ hours, and one man with a pneumatic pick averaged one mortise completely chipped out in a similar length of time. These tools were also used for drilling concrete form anchor bolt holes to a depth of 6 in.

FIG. 8.

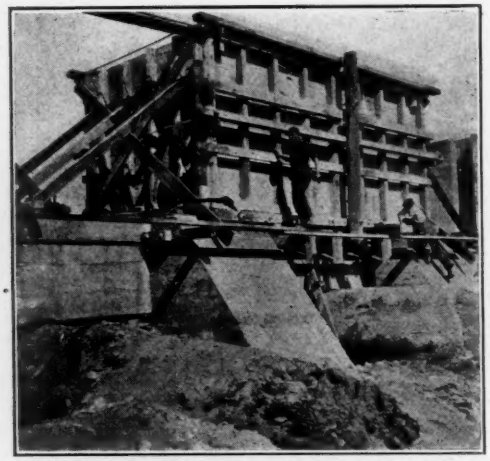


FIG. 9.

The air was supplied to the drills and picks by a 9 and 9x8 in. Class FR Piston Steam Valve Compressor through the 2½ in. pipe used as a supporting rail for special Jackhamer hangers. All steel was sharpened by hand, a total of 60 pieces of 12 in. lengths being required for the job, which comprised 213 mortises, 775 ft. of channel and more than 500 6 in. anchor bolt holes.

To obtain a suitable rock footing for the buttresses the overburden at the base of the dam was removed with pick and shovel. Where the natural contour of the rock did not provide a satisfactory footing, holes were drilled with the Jackhamer and blasted, the object being to obtain a saw-toothed surface.

Fig. 8 shows a Cameron Pump at work keeping the excavation free of water. This pump was shifted along from point to point, as required.

FIG. 10.

CONCRETING

Collapsible wooden forms were used for all concreting. See Figs. 9 and 10. Forms for the buttresses were shifted by stages towards the top, each pouring of concrete being permitted to set sufficiently before shifting the form. For keying each successive pouring of concrete, large pieces of rock were embedded in the concrete at the finish of each pouring. Each partially set batch of concrete was thoroughly wetted down before the next pouring.

For shifting the concrete forms, handling the rock and overburden at the base of each buttress, and also for dirt filling between buttresses, the Lidgerwood Traveling Hoist, shown in Fig. 11, was employed. The object

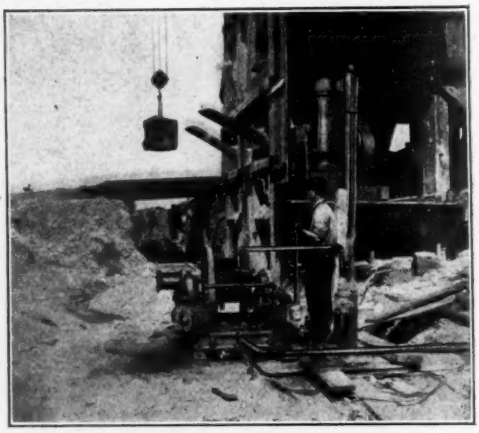


FIG. 11.

of the dirt filling is not only to lend additional support to the concrete structure, but also to eliminate the opportunity for freezing and spalling during cold weather.

The concrete plant, comprising two 1 cu. yd. steam engine driven Ransome concrete mixers, is located at the western end of the work. All materials are supplied to the mixer at the top by means of a Lidgerwood Boom Derrick and Clam Shell Bucket.

A unique feature of this portion of the installation is the manner in which the concrete is conveyed to the Lidgerwood Cable Way which serves the dam. Fig. 12 is a general view overlooking the dam, taken from one of the cable way towers.

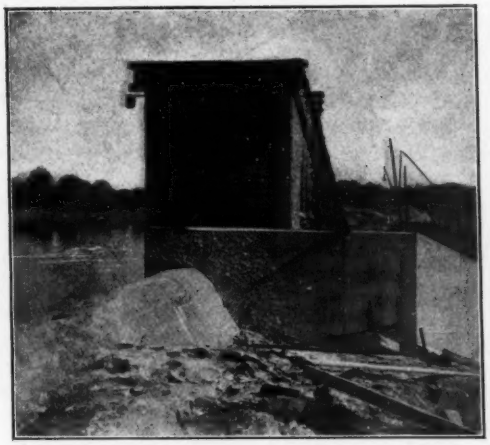


FIG. 12.

A smaller steam operated winch carrying an endless cable hauls a flat car back and forth on a track placed at right angles with the cable way and parallel with the concrete mixer dumping chutes. Hand operated square dumping buckets are placed on this flat car and run in under the chutes. One is filled and returned to the dam where the cable-way traveler picks it up and conveys it to the point of deposit. In the meantime the other bucket is being filled.

The concrete mixture is as follows:

1 2½, 4½ for the top.

1 3, 5 for the buttresses.

All materials for the concrete are hauled in by four 5-ton locomotive trucks. Two of these trucks are equipped with power self-dumping bodies, the other two with hinged bodies, which are dumped by means of the derrick serving the mixers.

The company operates its own Trap Rock Quarry, situated about 2 miles from the dam. The trap rock, which is of a particularly hard, stubborn nature, full of cleavages and therefore presenting unusually difficult drilling, is excavated by means of three D-24 Sergeant Steam Drills. The average drill hole footage is low and gives a fairly good idea of the character of the rock; 12 ft. per day per drill operated by 2 men.

A No. 5 McCully-Gyratory Crusher installed at the quarry crushes all the rock, the straight run of crusher material larger than ⅜ in. being used in the mixers; none of it, however, runs larger than 2½ in.

Considerable preparatory work had to be done before actual work started at the dam. It was necessary to build new and higher roads to replace those which would become inundated by the enlarged reservoir, to say nothing of the grading of certain portions of the reservoir banks and the clearing of the new land. Holt Gasoline Tractor being called into service for pulling tree stumps, etc.

The work is being done by the water company itself, known as the Bridgeport Hydraulic Co., under the supervision of its own engineers. Mr. S. P. Senior, Vice-President of the Company, is Chief Engineer, Mr. W. C. Pollitt is Engineer in charge of the work, and Mr. A. B. Hill, the Consulting Engineer.—*Engineering News, with additions by the writer.*

WAR SCRAP

It looks, on the surface of things, as if the battle-scarred farms around Verdun and other contested districts of the European war might be devoted more profitably to mining than to agriculture, upon the conclusion of peace. The statement has been made that as many as a million shells a day were fired for many days in succession by the Allies in France alone. This, of course, is above the average, but it does not take into account the outpouring of steel from the big guns of Germany.

Let us assume that the average was a million shells per week, from each of the contesting sides, on the area in front of Verdun. The fight raged for some thirty weeks; on this basis, therefore, some sixty million shells were thrown. Calling the average weight per shell one hundred pounds, this means that a total of three million tons of steel were thrown upon a disputed area of, say, one hundred square miles, sixty-four thousand acres, which steel is now somewhere under the surface of the ground. According to these figures, the average weight of steel per acre is about forty-seven tons, worth, as scrap, perhaps twenty dollars per ton.

Add to these estimates, which, of course, are largely guess work, the enormous tonnage of barbwire entanglements, construction steel and other wasted material of war and we have a metal value far exceeding the purchasing value of the land. It might cost more to recover much of this steel than it would be worth in the market; nevertheless, it is unthinkable that the thrifty Eureopeans will not recover a

great deal of this scrap when the warring nations finally get through with their "scrapping."

THE AIR PROBLEM IN ICE MANUFACTURE

The principal method of manufacturing ice at the present time is by what is known as the "raw-water system." When the manufacture of ice was begun as a commercial proposition and for many years thereafter it was considered essential to use nothing but carefully distilled water. This was not only for the purpose of producing pure ice but also ice that would look right. If untreated water is converted into ice the air which is always present in the water gives the ice the appearance of frozen snow, and "snow ice" is always objected to.

By elaborate distillation the greater part of this air may be eliminated. This entails the turning of water into steam and reboiling it. For the purpose of economy it is the custom to operate an ice plant with a steam engine and use the exhaust steam from this engine for producing the distilled water. Such a practice meant that the lubricating oil in the engine cylinder would come in contact with the steam, and one of the first steps in the distillation is grease separation to remove this oil. As a matter of fact, a great deal of difficulty is experienced in the eliminating of all such oil and foreign matter.

The elaborate distillation and filtration of the water to be frozen is responsible for the flat, insipid taste of hygienic ice. The frequent claim that ammonia finds its way into the ice can also be attributed to lubricating oil or other substances, which are often found in the frozen product.

The demand for a product which would be more like natural ice in its taste and odor, and at the same time be free from dirt and impurities, has brought about a radical change. As is generally known, ice is produced in rectangular cans or forms. By suspending a tube or other similar arrangement in these cans, through which air at suitable pressure is discharged, the water in the ice cans is kept in a constant state of agitation, and this causes all of the air bubbles to rise to the top and dissipate themselves in the atmosphere. The result is a clear, transparent block of ice, made from pure natural water, without unusual taste or odor, and on the whole is far more satisfactory than hygienic distilled water ice.

Of course, the water used must be pure, and if it contains any dirt or foreign matter, good filters are necessary. Practically every raw plant is so equipped.

The demand for a better product is one reason for the change. Perhaps a more important reason is the fact that the necessity for a large amount of steam is avoided. This makes it possible to use oil engines, electric motors or highly economical steam engines, which would not have enough exhaust steam for a distilled-water plant. In other words, a raw-water plant may be operated at a much cheaper cost. For example, an old-style icemaking plant, to produce 50 tons of hygienic distilled water ice every day of 24 hours, would use in the neighborhood of 10 tons of coal. Let us suppose that this coal would cost $4 per ton. This would mean $40 per day, or 80 cents per ton of ice manufactured.

It is quite possible to operate a raw-water ice plant, driven by a una-flow steam engine, and produce the same amount of ice with about three tons of coal, or a daily fuel cost of $12, which equals 24 cents per ton.

SPEEDING-UP THE COMPRESSORS.

Another great stride in advance has been made possible in ice and refrigerating machines by the perfection of what might be termed "high-speed ammonia compressors." The compressor, being the most vital part of an ice machine, has always been very carefully designed, and for 30 or 40 years a speed of 70 or 80 revolutions per minute has been considered the maximum. Many of the machines of the older types ran at not more than 40 or 50 revolutions per minute. Owing to this relatively low speed the use of oil engines or other economical forms of prime movers always meant the adoption of rope or belt drive or some other form of indirect transmission. In small plants rope or belt transmission may be without any great difficulty, but in large plants, especially where oil engines supply the power, such transmission is a great source of trouble and annoyance. The ropes or belts wear rapidly and sometimes break, causing damage and danger to life and limb. Moreover, they are a source of power loss. This amounts to 10 to 20 per cent. of all the power transmitted.

In a 500-horse-power plant a 15 per cent. loss might easily mean over $3,000 or $4,000 a year. About 18 months ago a horizontal

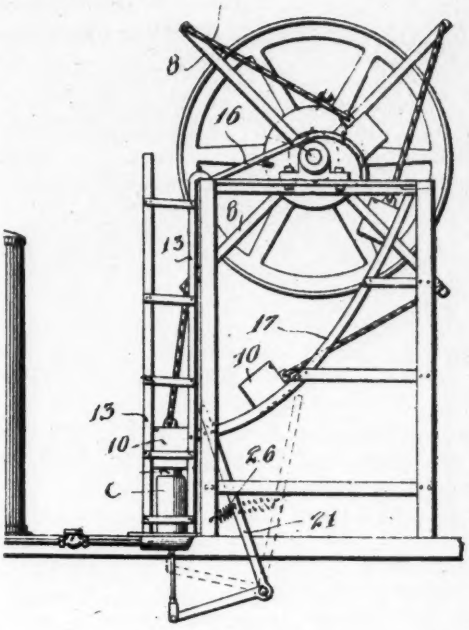
ammonia compressor of the high-speed variety was perfected, and now there are 15 or 20 large units in actual operation. These machines are direct connected to oil engines, electric motors and una-flow steam engines. They operate at from 125 to 250 revolutions per minute. The design is such that less vibration occurs than in the old types of machines. Thorough and automatic lubrication is insured by special oiling systems, and the new cylinders need very little attention. Of course, the valves are of unusual design, being of the plate variety, which have been used so successfully in air compressor work.

It seems quite safe to say that in a comparatively short time the ice machine which runs at only 50 or 75 revolutions per minute will be out of date, because it will prove higher in first cost, necessitate more foundation and building space and be less economical. A belt-driven slow-speed machine might need a space 60 feet long, whereas a direct-connected high-speed equipment could be placed in a space not more than 20 or 25 feet long. The engine-room equipment of a 100-ton oil-engine-driven icemaking plant using rope or belt drive would occupy a space of about 60 feet long and 50 feet wide. With a direct-connected high-speed compressor arrangement the space would be reduced to 30 feet in width. —*Robert P. Kehoe, in Manufacturers Record.* (Condensed extract).

AN INGENIOUS AIR COMPRESSOR

The cut above is reproduced from a recently issued U. S. patent. It illustrates how far afield erratic ingenuity can go to accomplish a simple operation. As the specification reads the purpose of the invention is "to generally improve and simplify the construction and operation of air compressors so as to render them more practical, reliable, effective and efficient in operation and less expensive to manufacture and operate."

Any one can easily see how the thing is meant to work. Whether such a thing has ever actually worked we have some doubts. The side of a vertical air receiver is seen at the left. There is a single acting upright compressing cylinder at *C* with the piston normally at the upper limit of its travel. Across the top of the frame there is a horizontal shaft driven by belt or otherwise, and on this shaft there are four long arms *8* to the end of each of which is attached a chain and to each chain



NOVEL AIR COMPRESSOR.

a heavy weight *10*. By the continuous rotation of the shaft the weights are successively drawn up the inclined curved slide *17*, then over the curved slide *16* until vertical guides *13* are reached. Then the weight drops freely between these guides, strikes the top of the compressor piston with a whang, the air contained in the cylinder is compressed and some of it is driven into the air receiver, this operation being repeated continuously.

After a weight has dropped, leaving it on top of the piston as shown, it is drawn up slide *17* again, and so on. As it begins its travel up this slide it comes in contact with the arm of a bellcrank lever *21*, pushing it over to position shown by the dotted lines, this movement raising the piston in the cylinder with the thrust of spring *26* to hold it there until the next weight drops.

Tenders for the construction of 148 aeroplanes for the American army which were recently opened showed a remarkable diversity in prices and climbing ability. The prices varied between $12,000 and $30,000 each. The highest speed guaranteed was 90 miles per hour, and the lowest 65 miles per hour. As regards climbing ability the best offered was 6,500 ft. in ten minutes, and the lowest 2,000 ft. in the same time.

PNEUMATIC GRAIN ELEVATORS AND CONVEYORS

At a recent meeting of the Manchester Association of Engineers a paper was presented by Mr. Cecil Bentham on Pneumatic Grain Handling Appliances. The Engineer, London, reports as follows:

He said that as we in this country were largely dependent on imported grain for many necessities in addition to our daily bread, this fact, together with the importance of discharging ships quickly and economically, made this problem of the first importance to the nation. The purposes to which grain elevating plants are applied were divided into the following three heads: (1) Discharging ships either to quay or to barges. (2) Discharging barges at mills or granaries. (3) Conveying grain long distances. The method of conveying the grain is to create a partial vacuum in a receiving chamber by means of an exhauster or pump; the air rushing along the conveying pipe carries with it a stream of grain from a nozzle at the free end of the pipe line depositing it in the receiving chamber at the other end. The grain is then discharged from the receiving chamber by means of some form of valve and is afterwards dealt with mechanically.

The advantages of using a pneumatic plant in the first two methods mentioned, namely, for discharging ships or barges, were enumerated as follows: (*a*) The amount of labor is considerably reduced as compared with any other means of discharging grain, this being due to the fact that a pneumatic pipe will pick up nearly all the grain from the floor of the ship or barge without being "trimmed," as is necessary in the case of bucket elevators, grabs, etc. This avoids the necessity of engaging a large number of casual men when a cargo is being discharged. (*b*) It is healthier for the men engaged in discharging grain with pneumatic plants than with bucket elevators or other mechanical appliances. All grain contains dust varying in quantity and composition according to the condition or the part of the world in which the grain is produced; with ordinary buckets this dust is stirred up and permeates the atmosphere, and it is then breathed by the men who are working in it. The dust is deleterious to the men, dust from maize especially affecting the eyes. (*c*) By passing the grain through the pipes in a strong current of air it is aspirated, and if the temperature of the grain has risen on the voyage, the effect is to improve its condition. The vacuum is also supposed to kill weevils and mites, though the evidence on this point is not sufficient to form a definite conclusion at present. (*d*) Some amount of dust is also separated from the grain during its passage through the pipes and may be discharged from the plant separately. This separation is taken advantage of in mills where the grain is used, but whilst in transit it is still unfortunately considered necessary to put all the dust back into the grain in order to avoid loss of weight. (*e*) With pneumatic tubes the poop and bunker hatches may be discharged without any special scheming, because it is only necessary to pass the grain pipe down into the hold, and all parts of the hold may be reached even when difficult corners have to be negotiated. Where bucket elevators only are installed it is frequently necessary to discharge these holds entirely by means of hand labor. (*f*) Parcels of grain are sometimes separated by cloths, and in these cases the pneumatic method is the only one except hand labor which entirely obviates the risk of mixing. (*g*) Discharging can proceed in all kinds of weather, as it is only necessary to keep the hatch open sufficiently to operate the pipes. (*h*) The average capacity of a pneumatic plant is near its maximum capacity, whereas with the mechanical plant the average capacity is only a small percentage of the maximum capacity.

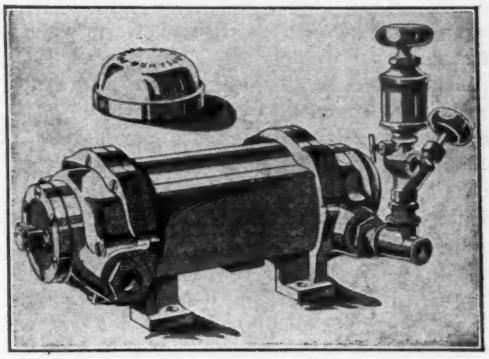
The author then went on to describe one or two typical plants made by the firm of Henry Simon, Limited, the chief features of which have already been dealt with in *The Engineer*. He said that one of the early objections to the use of pneumatic plants was the comparatively large amount of power which was absorbed. In the early plants about 4 horse-power was absorbed per ton of grain per hour handled when discharging ships, whereas now the power is from 1 to 1½ horse-power. For conveying grain considerable distances this power is considerably exceeded, and if mechanical appliances can be used the pneumatic method is not economical for long distance conveying. It, however, frequently happens that there are more or less serious obstructions in the way of introducing mechanical appliances, whereas a single pipe may be taken in any desired direction with very little inconvenience.

The power absorbed by a pneumatic grain-handling plant is extremely large in proportion to the actual work done. In a well designed plant in fairly good condition the mechanical efficiency would only be from 5 per cent. to 6 per cent. This, the author said, was perhaps not a very satisfactory method of stating the power absorbed, because theoretically, no work is done in conveying horizontally, and most pneumatic installations for discharging ships or barges inevitably involve the passing of the grain in a horizontal direction in addition to a vertical direction. If, however, pneumatic plants were compared with purely mechanical appliances, such as bucket elevators, which up to recent years were the most general method of discharging grain, it was found that the power absorbed by a pneumatic plant is still comparatively high. On the other hand, the bucket elevator for discharging ships is somewhat complicated, especially where large variations in height have to be dealt with, but when in good condition and working at a maximum capacity, it gives a mechanical efficiency of 50 to 60 per cent., but to obtain an average capacity equal to a pneumatic plant a bucket elevator would require to have a larger maximum capacity with consequent additional running losses.

CLARK COMPRESSED AIR METER

The great need of some means of accurately measuring compressed air in actual use is indisputable. It is not only desirable to measure the output of the compressor as the only sure guarantee of its efficiency but it is equally necessary to measure the air supplied for the driving of individual tools and groups of tools to determine the cost of operation. A reliable meter will also furnish the best evidence at to line leakage or other losses of air.

The cut here presented shows the essential features of the Clark air meter recently placed upon the market by the Denver Rock Drill Manufacturing Company. This is a positive displacement meter and no air can get through it without actually occupying the cylinder space and being duly recorded. Referring to the cut, the air enters the meter through the nozzle at the right hand end and leaves the meter at the left hand end passing on to drill or other tool which is being operated. In the passage of the air through the meter it forces a piston full stroke back and forth in the cylinder, so that the volume of the cylinder



CLARK AIR METER.

multiplied by the number of strokes gives the quantity of air that has passed. The strokes are automatically recorded by a simple counter at the left hand end, the cover of this being removed and shown in the cut above the meter. In connection with the reading of the meter, the temperature and the pressure of the air, a simple calculation gives the free-air record.

The meter as shown is made in one size only, capable of accurately measuring any quantity of free air up to 200 cu. ft. per min., this being sufficient for the operating of any drill or other machine about a mine. Generally speaking, the meter is intended to be placed close to the machine whose air consumption is being tested and to which it is attached in series by suitable short connections in such a manner that the air passes through the meter and is recorded before actually doing its work.

SOME MINING TRUTHS

If mining were as simple as the uninitiated would have us believe, all that would be necessary would be to shoulder a pick and shovel, hammer, drills and powder and a plentiful supply of provisions, and go forth and dig a hole in the ground, extract the wealth therefrom and come home rich. At least that resembles some of the pictures so often presented by eastern promoters in prospectuses calculated to sell mines of questionable worth.

In the early days of mining in any region the pioneers were the prospectors who learned what they know about ores and ore occurrence by direct observation or associations. Their knowledge, which sometimes appears to be instinctive, is not all that is necessary to make a good mining man. They have done and are doing a good work, however, and it is the

results of their explorations that usually determine whether or not a region is worth while as a mining possibility.

There have been mines so rich that they could be operated at a profit even by people who were practically ignorant of mining matters. Such mines are, however, rare and there are at the present time few that will yield up their mineral wealth to advantage except under competent direction, for mining has arrived at such a stage that it is a science. It is, in fact, even more than that; it is a combination of many sciences in the application of which many practical points must be taken into consideration, some of them involving great difficulties.

There was a time, when mining was a comparatively simple business, in the conduct of which no special training, other than a little practical experience, seemed to be required. That time, however, is now long past and mining, except in rare cases, can be profitably carried on only under the direction of men who have been broadly educated in the many branches of theoretical and applied science that have now become essential to the successful conduct of mining operations. These conditions have evolved the mining engineer of today, whose advice is as necessary in mining as that of the doctor to the sick man or of the lawyer in business.

And then, too, mining has become a complicated industry and is being carried on upon a grander scale than was dreamed of even a generation ago. This rapid development has involved the development of many industries directly dependent on mining, and in which there is sharp competition. As a consequence, every means to bring mining and its allied industries to a scientific and business-like basis has been made use of.

NEW ICE MAKING PROCESS

A new process of making raw water ice has recently been patented. With this process the refrigerant is a neutral gas or air of suitable temperature which constitutes an atmosphere into which water is conducted in such a manner that the water is formed into ice. According to one method the water, which is preferably pre-cooled, is supplied in the form of a sheet that initially flows down a surface which may or may not be cooled by brine circulating in contact with the rear side, and directed toward this surface is a blast of the refrigerant gas or air which freezes the water, and as the flow of water and the current of refrigerant are maintained, the ice progressively builds up until the desired thickness is obtained. The refrigerant gas or air at no time acts through a film or body of ice to abstract heat from the water, as in the present can and plate systems, but interposed between the body of ice and the refrigerant is a film of water which, in part at least, freezes on the already formed ice. The advantage claimed for this process is that ice can be built up at the rate of from ⅛ to ¼ inch per minute, so that a block 12 inches in thickness can be produced in an hour or two as compared with 36 to 40 hours with the can method.

INCREASING USE OF MOLDING MACHINES IN ENGLISH FOUNDRIES

Molding machines, which, as we know, are mostly pneumatic, are coming into their own in English foundries. At a recent meeting of the Sheffield branch of the British Foundrymen's Association the following resolution was adopted: "As the foundry trade will have to be prepared for the period after the war, when it will be necessary to reduce the cost of production to compensate for increased wages, etc., it is essential that the subject of the application of molding machines should be fully discussed throughout the country and with this object in view, the various branches of our association should endeavor to secure the services of lecturers who are competent to discuss the subject from an impartial standpoint. It is hoped that the parent association will give every encouragement for the discussion of this topic and we feel that it is to the best interests of all concerned that this course be pursued."

ATMOSPHERIC HUMIDITY TABLE

The table upon the opposite page is reproduced from Bulletin No. 250, "Washing and Cooling Air for Steam Turbine Generators," just issued by Sprag Engineering Company, 93 Federal Street, Boston. The table, which is copyrighted by the above company, is entirely self explanatory and should be valuable for preservation and reference. The material embodied in the bulletin has been carefully prepared, is handsomely presented and should be a welcome acquisition to those who apply for it.

Dry Bulb Temperature Degrees Fahr.	RELATIVE HUMIDITY, PER CENT (PRESSURE 30.0 INCHES)														
	25	30	35	40	45	50	55	60	65	70	75	80	85	90	100
	WET BULB TEMPERATURE DEGREES FAHR.														
60	44.9	46.0	46.9	48.4	49.4	50.5	51.5	52.5	53.5	54.5	55.5	56.4	57.4	58.4	60.0
	.207	.248	.290	.331	.372	.414	.455	.496	.538	.579	.620	.662	.704	.745	.828
65	48.5	49.8	51.0	52.3	53.3	54.5	55.8	56.8	57.8	59.0	60.0	61.0	62.0	63.0	65.0
	.245	.294	.343	.391	.440	.489	.538	.587	.636	.684	.733	.782	.831	.879	.977
70	52.0	53.3	54.8	56.0	57.3	58.8	60.0	61.3	62.3	63.5	64.6	65.8	66.8	68.0	70.0
	.286	.344	.401	.460	.517	.573	.632	.689	.746	.803	.861	.919	.976	1.034	1.148
75	55.3	57.0	58.5	60.0	61.5	62.8	64.3	65.5	66.8	68.0	69.3	70.5	71.8	72.8	75.0
	.337	.403	.471	.538	.605	.672	.740	.807	.875	.942	1.009	1.078	1.145	1.212	1.346
80	58.8	60.5	62.0	63.8	65.5	67.0	68.5	69.8	71.3	72.5	74.0	75.3	76.5	77.8	80.0
	.393	.471	.549	.628	.707	.786	.863	.943	1.021	1.100	1.178	1.255	1.334	1.414	1.570
85	62.2	64.0	65.8	67.7	69.5	71.0	72.5	74.1	75.6	77.3	78.6	80.0	81.2	82.4	85.0
	.458	.550	.642	.733	.824	.916	1.007	1.099	1.191	1.282	1.374	1.466	1.557	1.649	1.832
90	65.5	67.5	69.5	71.5	73.5	75.0	76.5	78.4	80.0	82.0	83.2	84.8	86.0	87.2	90.0
	.533	.639	.746	.852	.959	1.066	1.172	1.279	1.385	1.492	1.598	1.705	1.811	1.918	2.131
95	69.0	71.3	73.3	75.5	77.5	79.3	81.0	82.8	84.5	86.5	87.9	89.3	90.8	92.2	95.0
	.618	.741	.864	.988	1.111	1.235	1.358	1.481	1.605	1.729	1.851	1.976	2.098	2.221	2.469
100	72.5	75.0	77.0	79.5	81.5	83.5	85.5	87.2	89.0	91.0	92.5	94.0	95.5	97.2	100.0
	.713	.855	.998	1.140	1.282	1.425	1.568	1.711	1.853	1.996	2.138	2.281	2.424	2.566	2.851
105	75.8	78.5	80.8	83.3	85.5	87.8	89.8	91.6	93.5	95.5	97.3	98.7	100.4	102.1	105.0
	.821	.985	1.149	1.313	1.477	1.641	1.805	1.969	2.133	2.298	2.462	2.625	2.790	2.954	3.282
110	79.0	82.0	84.5	87.0	89.5	92.0	94.0	96.0	98.0	100.0	102.0	103.5	105.2	107.0	110.0
	.942	1.129	1.317	1.506	1.694	1.883	2.071	2.260	2.448	2.636	2.825	3.014	3.201	3.390	3.766
115	82.5	85.8	88.6	91.0	93.8	96.3	98.5	100.5	102.5	104.6	106.6	108.2	110.1	111.9	115.0
	1.078	1.294	1.509	1.725	1.940	2.156	2.371	2.587	2.803	3.018	3.234	3.450	3.665	3.881	4.312
120	86.0	89.5	92.5	95.0	98.0	100.5	103.0	105.0	107.0	109.2	111.2	113.0	115.0	116.8	120.0
	1.231	1.477	1.723	1.970	2.216	2.462	2.708	2.955	3.201	3.449	3.693	3.939	4.186	4.432	4.924

THE OLD AND THE NEW IN ROCK DRILLS AND IN MINING PRACTICE

BY LETSON BALLIET

The question as to whether it would be profitable to discard the old type of piston drills in the Buckeye Mines of Tonopah, and to replace them with new and more modern drills, came up for decision during the summer of 1916.

We had an ideal opportunity for making a positive test. At one of our shafts, there was in operation one piston drill. This drill was driving a long cross-cut to make an air connection with the workings of another property. We had a long record of what this piston drill had done, together with its cost of operation, meant throwing $75 worth of steel and a $168 machine into the scrap heap (totaling about $250, including the freight on the machine) and replacing the machine with a new one, together with new steel.

The Denver Rock Drill Co. sent us a hammer drill, which we were to test, and to pay for if the test proved satisfactory. This new Denver Dreadnaught, Model 60, cost $275, plus freight, water tank, extra hose, hose fittings and new steel, which brought the total cost of the new equipment up to exactly $400. Thus the question came down to dollars and cents: "Can we scrap $250 in old material, and spend $400 to replace it with new?"

Our piston machine record was higher in

TABLE I. PISTON DRILL—OPERATING TIME.

Time setting up	82 min.	17% of 8-hr. shift
Shifting machines	66 min.	14% of 8-hr. shift
Changing steel	75 min.	15% of 8-hr. shift
Lunch.		
Morning and noon starting.....	24 min.	5% of 8-hr. shift
Oiling and cleaning.....	15 min.	3% of 8-hr. shift
Getting steel and water.....	15 min.	3% of 8-hr. shift
Tearing down and blasting.....	45 min.	9% of 8-hr. shift
Actual time piston motion.....	158 min.	34% of 8-hr. shift
Total of 8 hrs. equals.....	480 min.	100%

Note.—There were many variations from the above figures at times, but these figures are the average of a year's work upon piston drill mounted on a drill column, with the mucker helping with the setup, and one man running the machine after the setup. The air compressor, with this one drill working, was not started until the setup was made, and was stopped when drilling was finished. Thus 82 minutes of setup time and 45 minutes of loading and blasting time were saved on the compressor power. Compressor running averaged 5 hours and 53-minutes per 8-hour shift. Compressor stopped for 30 minutes at lunch time.

because there was nothing else being done through this shaft, and this was the only drill at work. The drill was supplied with air by a compressor that furnished air for no other purpose than to operate this drill and run a Leyner drill sharpener that was used only when the steel for this drill had to be sharpened.

This piston drill, a Sullivan F. F., 12 size 2⅝ in. piston, had cost $168 at the factory, plus freight to Tonopah, exclusive of bar, column, arm and saddle. There were about 500 lbs. of steel supplied for the use of this drill, because the company had plenty at the other properties, and was not running on short allowance of steel anywhere. This steel, made up, had cost the company about 15 cts. a lb. at the mine. The discarding of this machine

efficiency than those at any other mine from which we had been able to obtain any records, and showed as per Table 1.

This work was carried on with two shifts at work. The mucker came on shift at 7 a. m., took half an hour for lunch, and was supposed to be practically cleaned up by 1.30 p. m. The machine driller came on at 1.30 p. m., the mucker helped him with the set up and quit at 3.30. The driller took half an hour for supper and finished his shift at 10 p. m., after having blasted his round of holes. The mine was idle from 10 p. m. until the mucker returned at 7 a. m. the following morning.

The hoist engineer was a blacksmith and sharpened the steel upon the drilling shift, as he had no hoisting to do, except to lower the drill man and hoist the mucker. The hoist-

ing was done in a self-dumping skip, and a top man emptied the bin and built the dump.

This work required five men: One driller, one mucker and two hoist runners, one of whom was a blacksmith, and a top man. The pay was $5 a day for each man except the top man who received $4 a day.

The labor expense of this work was $24 a day. The compressor was in motion 5 hours and 53 minutes at a cost of 80 cts. per hour, or $4.71 per day (average for the month including the drill sharpening). The average progress of the best month was 4 ft. per day in advancing the face. The piston drill put in an average of nine holes to break the round, seldom ten, and several times but eight—depending upon conditions. The average amount of powder was about 65 sticks of 40% dynamite, 1⅛ by 8 in. During the month 163 pieces of drill steel were sharpened in the sharpener.

This was the record that the new hammer drill must beat. The odds were slightly against the drill in the fact that it was further away from the shaft. The air line was growing longer each month, as well as the tramming distance. There were 1,200 ft. to tram when the drill began, which necessitated two muckers. One mucker rightfully should have been charged up to "distance of tramming," and not to the drill expense. Otherwise conditions were the same for the work. Air was made by the same compressor; the same blacksmith sharpened the steel, and the same men operated the drill that had operated the piston machine

On account of the hammer drill being a faster cutting drill, a change was made in the work. Three men were put underground: One drill runner and two muckers. One hoist runner and one top man were maintained, and all the work was done in one 8-hour shift.

The set up was made on a cross bar instead of on a column. The first set up by the driller with the help of one of the muckers was on top of the muck pile. The other mucker began the work of moving the muck from under the driller, and when the drill was set up the mucker, who had helped with the set up, took another car and alternated with the first mucker by loading his car, while the other made a trip to the shaft and returned. In this way, by the time the driller had finished his holes from the first set up, the muckers were supposed to be cleaned out enough to allow the bar to be lowered for the second set up; if not, the driller "shoveled back" and one of the muckers helped him lower the bar.

Thus it will be seen that with the hammer drill the heading was advanced 11 ft. further in 31 days than with the piston drill, and it was in use only 7 hours per day, saving 12½% of the overhead costs per shift.

The ventilating fans ran 7½ hours per day instead of 15 hours as with the over-lapping shifts, and there were 7 hours of lighting the underground against 15 hours during overlapping shifts. The men were paid the same for 7 hours' work as had previously been paid for 8 hours, so there was nothing saved in labor costs, but the same 5 men accomplished 9% more progress by driving the crosscut a greater distance in 31 shifts for the same amount of wages that had been accomplished in 14½ hours a day for 31 days (62 over-lapping shifts). Thus they saved 52% of the overhead time.

The ventilation was done by means of a small centrifugal blower driven by a motor. Electric power was purchased from the Nevada California Power Co. at the rate of 4 cts. per kwh. The blower cost 4 cts. per hour to operate.

Electric lighting in the mine and on the surface during the night shift, made a difference of about $4.50 a month. This was com-

TABLE 2. DRILLING EFFICIENCIES.

Time for first set-up.....	*102 min.	21.25% of 8-hr. shift
Compressor running	130 min.	27.10% of 8-hr. shift
Lowering bar and mucking back	*89 min.	18.50% of 8-hr. shift
*Lunch.		
Compressor run on second set-up	45 min.	9.40% of 8-hr. shift
Tear down and blast.....	*54 min.	11.25% of 8-hr. shift
Total working time (7 hrs.)...	420 min.	87.50% of 8-hr. shift
Overhead costs for (1 hr.).....	60 min.	12.50% of 8-hr. shift

Advanced the face 4 ft. and 4 ins. per shift.
*Compressor stopped during these periods.

puted by the hours the lights burned and the size of the globes, as the lighting was on a 440-volt circuit, with four lights in series (not a particularly desirable way of lighting, but it saved considerable expense in wiring a separate lighting circuit, while this work was being done), and was included on the 440-volt meters.

The compressor cost 80 cts. per hour while carrying the piston drill, and 60 cts. per hour while carrying the hammer drill, owing to the fact that the piston drill required more air than the hammer drill. Much of the effectiveness of the piston drill was lost by the friction of the steel working forward and back in the drill hole. This also wore down the gauge of the drill bits, which required much more steel to be sent to the blacksmith to be sharpened and re-gauged.

During 31 days of 62 over-lapping shifts, the piston drill required the compressor to furnish air for 182 hours and 23 minutes, including that which was required in the shop to sharpen 163 pieces of steel. Power for running the compressor cost, at 80 cts. per hour, $145.91 for the month.

The hammer drill running 31 days required the compressor to be running 2 hours and 55 minutes a day, or 90½ hours in 31 days, and at 60 cts. per hour cost $54.30 for power, including 34 pieces of steel sharpened in the shop. This showed a saving of $91.51 in power on the compressor.

Although the hoist engineer sharpened the steel, in this case we must compute his time at $5 per day, and take such part of his time as he was engaged in sharpening steel and charge it to that item. On this basis we find that the piston steel cost us about 20 cts. per bit sharpened, including the building of the forge fire, heating, sharpening and tempering.

The hammer drill, on account of its rapid drilling, and ease of changing steel without the chuck nuts to work with, allowed the driller to put in an average of eleven holes to break the round; occasionally twelve; and all a little deeper than the piston machine holes. This was not directed by executive order, but was done by the driller who would rather put in an extra hole or two than to get down and "muck back," as it allowed the muckers to clean up a little closer for him.

This doubtless meant a little extra time of compressor running, a little more wear on the steel, and a few more pieces of steel to be sharpened in the shop. It required two more lengths of fuse and two extra blasting caps, but this was more than made up because the driller used from seven to ten fewer sticks of powder each day, by loading the bottoms of the holes and tamping heavier on top. Thus, these extra holes saved about 120 lbs. of powder which was costing us $19 per hundred pounds.

Being unable to determine what the power bill would have been with two less holes, except by the cost per foot of drill hole, we disregarded the item of "powder saving" as balanced against extra fuse, caps, power and drill sharpening. But these extra holes and increase in depth, netted us 11 ft. more progress with the crosscut in 31 days than the piston drill delivered.

With a labor expense of $744, the piston machine delivered 124 ft. of progress at a cost of $6 per foot, and with the same expense the hammer drill delivered 135 ft. at a cost of $5.51 per foot. Eleven feet increase in progress at $6 per foot gave us a net saving of $66.

It is obvious that there was a saving of incidental overhead expense, life of electric globes, wear or depreciation of machinery due to shorter operating hours, etc. But inasmuch as I have figured top labor, blacksmithing, lighting, ventilating and hoist engineer, we will ignore overhead, because the additional 11 ft. of progress required a little more power to hoist the rock excavated from this 11 ft. Thus these items can well be figured as offsetting each other.

If the drill had been nearer to the shaft, so that one mucker could have trammed the muck, there would have been one less man on the pay roll, saving an additional $155, but the long distance to tram from the face to the shaft required two muckers. While we did the same work in one shift that we did in two, we laid off one hoist runner, but sent an extra man underground at the same pay. Thus the total expenditure for labor was the same in both cases.

The fact that the men were able to finish their work in 7 hours instead of 8 worked a moral effect that caused them to do better work, to keep their pipe lines in good shape, to lay their shoveling plates well down so that they wouldn't be bent by the blast, and incidentally did many little things to facilitate

their work. As a result we are getting more for our money, making faster progress and the men are working 7-hour shifts for the same pay.

In other places where there would be a different wage scale, or a different power rate in effect, these figures would have to be modified to suit the case, but on an average it is safe to say the modern drills will pay for themselves and the steel in 3 months. If the same steel can be used, replacements of worn-out machines will pay for themselves every 2 months.

We have satisfied ourselves that it does not pay to continue operations with obsolete types of machines.

From this data it was seen that the old piston drill required the air compressor to be running 10,943 minutes (182 hrs., 23 min.), to deliver 1,395 ft. of drill hole, averaging about 1½ ins. of drill hole per minute, during every minute that the compressor was using power.

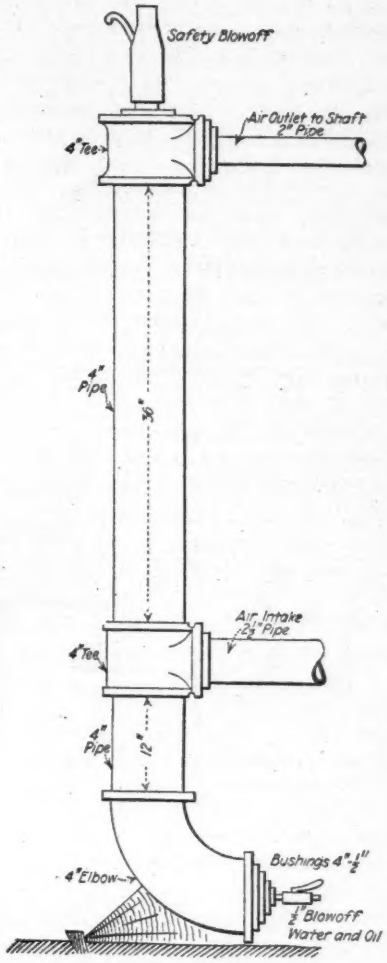
Also it was ascertained that the hammer drill required the compressor to be running only about half as long—5,430 minutes (90½ hours) to deliver 1,736 ft. of drill hole, averaging nearly 4 ins. of drill hole per minute (a foot every 3 minutes) that the compressor was in motion.

HAMMER DRILL PROGRESS

The Monarch Pittsburgh mine, as well as the Buckeye mines, have discarded their piston drills for hammer drills with hollow steel and water feed. The Midway is using Leyner drills of the same type, and several other operators are using some drills of similar design. There are a few managers who think that they cannot afford to scrap their old machines for new on account of the first cost, but it is very evident that their expenses are so much more that they are actually paying out the amount that the new drills would cost every 3 months, and it is only a matter of time when all the obsolete types of drills will be discarded.—*Min. World* (Condensed).

SEPARATOR FOR COMPRESSED AIR LINE

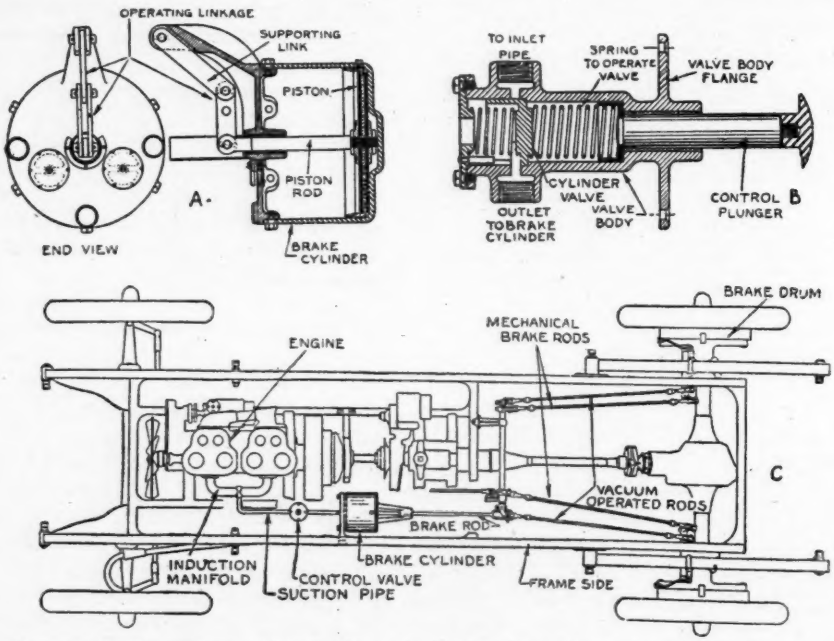
The cut here reproduced from a recent issue of Eng. and Min. Journal, contributed by Mr. J. F. Kellock Brown, Mining Engineer, Sydney, N. S., shows the arrangement devised and applied by him for separating oil and water from the air flowing from the compressor to the drills or other apparatus to be operated. The sketch tells practically everything requisite to be known; Mr. Brown remarking upon it as follows:



DRAINING THE AIR LINE.

The use and care of compressors or mining work is not scientific, the men available for the work are ignorant, and so it frequently happens that oil troubles develop in the machine underground. When you add to that the freezing due to moisture in the air, the value of any kind of apparatus that will help to mitigate these drawbacks in apparent. A separator should of course go along with every compressor, but we all know what prospecting outfits are; there is always something that should be there but never is sent, and a sepa-

rator on the air line is one of the things frequently conspicuous by its absence. Usually there is nothing available from which to make one. This at least was the case on the work where the separator described was used. Its construction will readily be understood from the illustration, pipe and fittings being all that is required. The air intake from the compressor was a 2-in. line and the outlet 2½-in. The separator itself consisted of 4-in. pipe with the necessary tees and elbows to suit. Above the air exit the 4-in. tee was bushed down to hold a 2-in. safety valve, while the foot of the separator, which ended in an elbow, was also bushed down to hold a ½-in. turn-cock taken from an air drill. By watching and keeping the lower space clear of the collected moisture and oil that came over from the compressor, a great improvement in the quality of the air was obtained.



Vacuum brake system and its parts. A. End and sectional views of the brake cylinder. B. Sectional view of the control valve. C. How the brake system is installed

THE VACUUM OPERATED BRAKE

No one familiar with current mechanical engineering practice will deny that the airbrake so widely used in railroad work is the best form for this purpose and one that makes it possible to control a heavy moving mass with minimum exertion on the part of the operator. The idea of using an airbrake on automobiles is not new, as various modifications of the Westinghouse braking system have been designed and fitted to cars in an experimental way. A new form of brake actuated by vacuum or engine suction has been worked out that makes it easy to control the speed of the largest and heaviest automobile with very little exertion. As it is being marketed by an accessory manufacturer of national reputation after severe tests it is evident that this system of braking should be given some consideration. The idea of the brake operation is the using of suction prevailing in the intake manifold while the engine is running. While the reduction in pressure is but a few pounds per square inch, this may be converted to a useful force by using a piston of large area. The inventor states that a force of about 10 pounds to the square inch is available as a rule and as the diameter of the piston is 7 inches and its effective stroke 4 inches it will be evident that a considerable force for brake actuation is available at the piston-rod. This is joined to a system of reducing levers which reduces the travel

of the brake-rod and multiplies the operating force considerably. The construction of the air-brake cylinder, the control valve, and the methods of installing the various units in the frame of a typical automobile are clearly outlined in accompanying illustration.

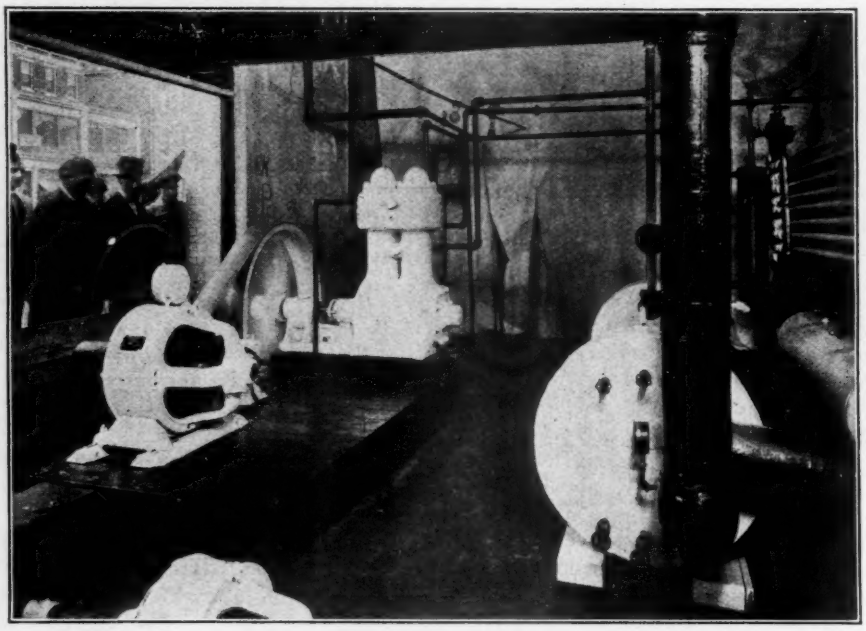
A control valve of a simple construction is interposed in the pipe line joining the intake manifold and the brake piston chamber. This valve may be operated either by hand or foot as is most convenient. The internal construction of the valve is such that the brake may be applied with different degrees of pressure. As the pull on the brake-rod is determined by the depression in the brake cylinder, anything that will lessen or increase this depression will correspondingly alter the braking force. The valve does this automatically. When the control plunger is depressed, this compresses a spring which moves the cylinder valve and provides a passage between the suction pipe and the brake cylinder and also prevents the entrance of air. Just as soon as the pressure back of the valve is reduced, the pressure of the air on the other side forces it up against the spring, closes the suction passage and in this way the amount of vacuum in the brake cylinder is controlled by the degree of movement of the control plunger. The spring is of such strength that if the plunger is fully depressed the valve will not be opened by air pressure. As soon as the operating lever is released the valve cylinder moves back to the position shown in the drawing, cutting off the suction opening and providing a bypass so that the outside air goes into the cylinder, releasing brake.

The cylinder construction is similar to that used in braking railroad trains. The cylinder is of pressed steel and the head is a steel casting. The weight is but 12 pounds. The simple steel piston uses a leather cupped washer packing. As long as the engine is running, or rather turning over, whether the motion is produced by the explosion of gasoline in the cylinders or by the overrunning action of the rear wheels when descending a grade, which of course, drives the engine through the axle driving gears and propeller shaft, a full application of the brakes is possible. The method of installation consists of connecting the brake cylinder to the intake manifold by a length of tubing in which the control valve is interposed. Instead of connecting the brake linkage to a foot pedal or hand lever, it is attached to a link operated by the piston-rod, which is clearly shown in the detailed drawing of the brake cylinder. It is said that sufficient power is obtained to slide the wheels even if the car is running at a speed of but one-half mile per hour. In tests this very slow speed was obtained by driving the car through the medium of the electric starting motor.

SUGAR BEETS MUST BREATHE

It is generally known that sugar beets breathe mainly through their leaves; but it is also true that the soil may play an important part in furnishing oxygen to the plant by way of the roots. It is a recognized fact that with beets, as with all other cultivated crops, it is necessary to have a certain amount of oxygen around the roots. Experts differ as to the office the roots have in the absorption of oxygen; nevertheless, every farmer knows that the roots of all cultivated plants require oxygen around them for their healthy growth. Hence it is essential that the soil shall be so cared for as to permit proper aeration.

The fact that proper cultivation renders the soil capable of admitting oxygen to the roots explains to some extent why the agricultural experts of the various beet sugar companies lay considerable stress on the matter of cultivation. There is another important function of cultivation which must not be overlooked, that the stirring up of the soil permits the escape of noxious gases that are perhaps given off by the beets themselves or are produced by the action of bacteria on the remains or excreta of other plants. All plants are very sentitive to gases, hence it is necessary that these be permitted to escape before they injure the plant. In view of these facts, it is obvious that proper cultivation plays an important part in the building up or the maintenance of soil fertility. In addition to this, ventilation plays an important part in the supplying of oxygen for the purpose of oxidizing the organic matters given off by the beet. Thus we observe that by proper cultivation the plant is not only supplied with oxygen, but that proper ventilation of the soil is brought about and this permits the escape of noxious gases, in addition to furnishing sufficient oxygen to the soil to oxidize the existing organic matters, which might exert considerable influence upon the fertility of the soil.



PORTABLE REFRIGERATING PLANT.

THE HIPPODROME TRAVELING SKATING RINK

The skating on real ice which has been the supreme attraction of the New York Hippodrom for two or three years has proved such a money making feature that it is to be exhibited in duplicate in the other large cities of the country. While it was of course costly there were no great engineering difficulties encountered in staging the ice ballet at the Hippodrome where the show was to run the entire season, but it is quite another thing to transport a skating rink around the country with only a short run in each place.

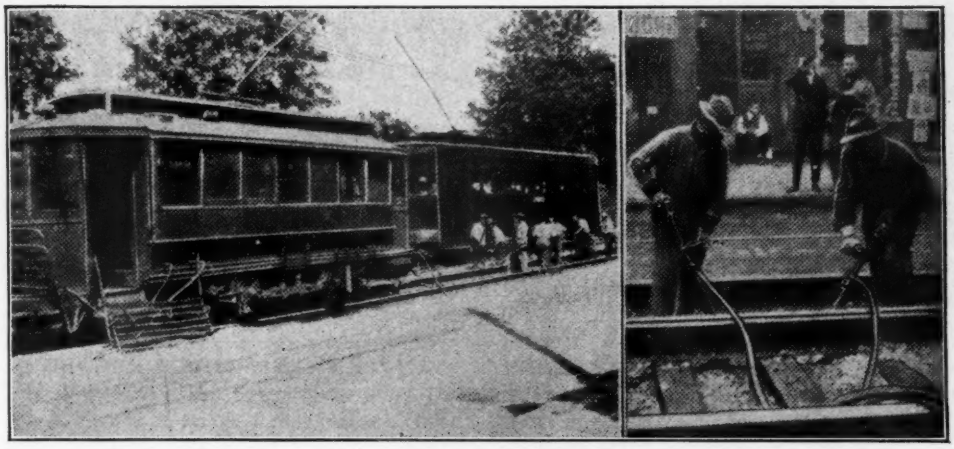
When it was decided that the scheme was practicable and that the entire Hippodrome spectacles of "Around the World" and "Flirting at St. Moritz," the most realistic and brilliant ice ballet ever staged should be shown in many other cities, the ice plant shown by the accompanying half-tone proved a complete and satisfactory solution.

The various units of this plant are transportable, each being mounted on a skid or stand, so that when the show closes at any point it is only necessary to take down the piping, haul the different pieces of apparatus, on a truck, pack them into a car and ship to the next showing place. To prevent the loss of time required to erect the plant and freeze the water, which takes 24 hours, duplicate outfits are used. While one is working in one city the other is being set up at the next point, so that everything is in readiness when the company arrives. The first plant then goes to the succeeding appointment, and so on.

Each plant consists of a 10-ton York compressor, with two cylinders each 6½x6½ inches, driven by a 20 h. p. direct current Westinghouse motor, and a 60 kw. Westinghouse motor generator set. Where direct current is available, the motors are operated from the power circuit, but as usually only alternating current is to be had, the motor generator set is used to transform the alternating current into direct current for the operation of the motors.

The brine tank has a capacity of 1,900 gallons. The ice pond formed on the stage is 45 feet long, 20 feet wide, and 4 inches deep. While being frozen, the water is held in place on the stage by a canvas tub. The ice surface is covered or concealed for the acts which precede the skating.

Two things less than each other must be also reciprocally greater than each other.



TAMPERS AT WORK.

PNEUMATIC TAMPERS CUT LABOR COST IN HALF IN PITTSBURGH

The Pittsburgh Railways was one of the first to use pneumatic tampers. The present equipment consists of two compressors, each of which furnishes power for a battery of six tampers. These machines have three lines, respectively 50 ft., 100 ft. and 150 ft. long, and each line takes care of two tampers.

The company is also planning to purchase five portable sets, made to handle four tampers each, in order to secure the convenience of working with compressor equipment that can be kept off the tracks where traffic is being maintained upon the tracks undergoing repairs.

As in other installations, the pneumatic tampers show a decided saving in cost, the saving per foot of track being about 15 cents, or one-half of the former cost. The proportionate saving in men, however, is greater, and this is an advantage, particularly as the much smaller force that is required is of a higher grade. There is only 30 per cent. of the force used that would be required for hand tamping.

The ballast used in Pittsburgh is classified as "coarse," in which sizes up to 2½ in. are used, and as fine, in which 1 in. is the largest size. The machines tamp both classes of ballast much better than was customary with hand labor. Though the tamping is done as a rule with the 1-in. ballast, the rough ballast is spread, compacted and rolled to a depth of about 6 in. before the track is laid.

The company has also taken advantage of the Ingersoll-Rand tamping equipment to reduce the first cost of Thermit welding outfits. The ordinary preheater used in connection with Thermit joints includes a blower outfit which costs about $600. The Pittsburgh Railways only find it necessary to use of this outfit the tanks and burners, costing about $35, to do the preheating in connection with reduced air pressure supplied from the compressor outfits.

A second incidental advantage of the tamping equipment is the forthcoming use of small air drills, which are lighter than electric drills, in making joints immediately following the tamping. Also, having compressed air on the job, it may be found to be useful to run air drills to break up and remove concrete.—*Electric Railway Journal.*

SOME PRESSURE

Under a pressure of 1,035 pounds per square inch and flowing at a rate of 260,000 barrels a day, a well, known as Cerro Azul No. 4, near Tampico, Mexico, said to be the greatest oil well in the world, was recently brought in by the Mexican Petroleum Company, Ltd. The well casing had been tested to a pressure of 1,050 pounds, which was practically equaled by the pressure registered after the well was closed. The force of the escaping gas under this pressure blew the two-ton drill bit out with it and threw it 125 feet from the well. Its cable became entangled with the valve at the top of the casing and tore the latter off. The drill bit and the escaping oil, which subsequently rose to a measured height of 600 feet, demolished the derrick. It is estimated that 1,000,000 barrels escaped before the flow was shut off.

SUCTION ELEVATORS FOR SMALL COAL

Since Mr. Duckham, the then engineer to the Millwall Dock Company, invented, about thirty years ago, his suction elevator for handling grain, his idea has been further developed, especially in the United States and Germany, not only for the conveyance of grain, but also of ashes, slack, and other small materials. The principal advantage of the pneumatic system—working either by blast or suction or the two combined—is that it gets rid of the dust nuisance which is so distressing to the workers. Some years ago in Hamburg grain elevators for the Hamburg American Line, under the Duckham patents, were built and more recently an installation for the German Solvay Works in Bernburg for unloading lignite slack from railway trucks. This plant handles 15 tons of slack per hour. An iron mast is placed close to the railway siding, from which the suction pipe with a flexible joint is suspended, the height of the pipe being adjustable by a winch. The suction nozzle is guided by a workman, and the slack is raised into a large hopper-bottomed receiver, by the side of which a dust collector is placed, also hopper-bottomed. The exhaust pump is of the vertical type and is connected with the top of the dust collector by piping. Leaving this vessel the air is passed through a filter in order to intercept all fine dust, and then drawn out and ejected by the pump. The slack drops from the hopper into a trough, and is carried to its destination by a spiral conveyor.—*The Engineer*, London.

A JACKHAMER WORLD-RECORD

At the quarry of the Alabama Marble Co., one of the Jackhamer operators put down 100 4 ft. holes in marble in ten hours. This is drilling at the rate of 8 inches each minute of the day's work. The holes are nearly vertical, only a few inches apart, and are used for plug and feather work. With this close spacing the Jackhamers practically never stop. They operate on air supplied at 100-110 pounds pressure.

BARGAINS?

BY BERTON BRALEY

When the smooth-tongued salesman comes around with his talk of some new device,
Which he says is the niftiest thing on earth and worthy of twice its price,
He may be telling the gospel truth as clear as the light of day,
But the wise man mutters behind his hand, "It looks good, but will it pay?"

For the test of a grate, a metering device or recorder of CO_2
Is never its looks or the salesman's talk, but rather what it will do;
So the wise man gazes at plots and prints and hears what the salesmen say,
But quietly figures the costs and sighs, "It looks good, but will it pay?"

Or the man from the central station comes, and a plausible chap is he,
And he wraps himself in a mist of words like a roseate rhapsody;
He would junk your plant, and he'd sign you up on a contract right away,
But the wise man murmurs in accents low, "It looks good, but will it pay?"

Efficiency experts dope things out on the latest and smartest plan,
They count the strokes of each piston rod and the motions of every man;
And they're frequently right in their scheme of things and the logic that they display,
But the wise man nevertheless exclaims, "It looks good, but will it pay?"

Now there's room for progress in every plant, and the mossback's just a fool,
And the man who balks at the thought of change is worse than a stubborn mule;
But the "show me" chap has the right idea and never goes far astray
When he puts each change to the acid test—"It looks good, but will it pay?"—*Power*.

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WHO CAN BEAT IT?—EITHER THE STORY OR THE TELLING OF IT

Grant, Smith & Company recently completed at Senic, Washington, under the supervision of T. Walsh a 2,000 ft. tunnel approximately 20 ft. 6 in. wide by 26 ft. 6 in. high. To complete this tunnel they were required to remove 790 ft. of open cut rock to the outside faces, also build an adit 245 ft. and a small cut 88 ft., which gave them six working faces. Part of the mucking was done by steam shovels and the balance by hand, and horses were used to pull the muck cars.

They finished this work in exactly six months, working two ten-hour shifts a day, except Sundays when only light work was done. The air equipment consisted of one Ingersoll-Rand "AC" Compressor and one Rand "Type X" Steam Driven Compressor, twelve "C-110" Drills, eleven "Jackhamers," one wet "Jackhamer," five No. 18 Leyners, four 3¼ in. Piston Drills, five "BC-21" Stoping Drills, and a few other older drills. They made no attempt at speed except to finish the work in six months, as originally contemplated. In checking over their record they really did accomplish fast work, doing about a foot an hour per every hour worked. The rock was very seamy, and to start some of the faces a small pioneer tunnel was built and then worked back to the face, so as not to have the rock come down. Five hundred and thirty feet was timbered. They were also bothered with water and used several pumps.

An interesting part of the work was that 400 ft of the tunnel was driven by one "Jackhamer." This tool did remarkable work for its size.

The No. 18 Leyners had previously driven a 3,000 ft. tunnel in Oregon, and when this job was finished were still in pretty good shape.

F. C. BRUHNS.

Seattle, Wash.

The above letter we know will be welcomed by the readers of Compressed Air Magazine for its intrinsic value and importance, and it is especially appreciated by the editorial department as typical of what we are continually pining for. There are compressed air operations and achievements concerning which specific information would be of the greatest interest and profit to our readers, but unfortunately nobody does the telling of it. There

are men enough who can tell a straight story when talking to a friend about what has been done or is being done who never think of writing it, when really one is just as easy as the other. Write as you talk. Scribble it off with a lead pencil; pay no attention to spelling, punctuation, sentences, paragraphs or capitals, just give us the facts and as many as possible of them. We will put it in shape and everybody will be benefited.

NEW PRECEDENTS AND INCREASED PROGRESS IN TUNNELING

The adoption of the shield method for construction of a small tunnel in Milwaukee in fairly good ground is one of various recent occurrences that tell of progressive, original activity in the field of tunneling. It is a fact that tunnel construction is among those fields of civil engineering work where marked advance is being made.

Within the past month two compressed-air tunnels of great difficulty were holed through, the Old Slip tunnels under the East River at New York. Various elements contributed to the success, which in the aggregate mean distinct progress in the art. Rapid control of face work, deep and wide blanketing of the river floor, and a highly original void-filling method —"grouting" with gravel by air ejection—are the chief of these elements.

A few months back the completion of the Rogers Pass tunnel, a sound-rock tunnel, signalized the brilliant success of a radically novel method of attack in rock. The system of blasting in rings from a central pilot tunnel, a bold innovation, was the key to success. Though centuries of prior art in rock tunneling were available, sound engineering in this case lay in abandonment of precedent.

Precedent was cast aside similarly in the new Cleveland intake tunnel under Lake Erie, which also was holed through a few weeks ago. The stereotyped form of lining for shield tunnels —cast-iron segments—was dropped, and a lining of concrete blocks was substituted. The economy of this expedient is obvious, iron being costly. But whether a long tunnel, with all its contingencies and hazards, could be built of concrete blocks in successful manner had to be proved by experience.

With new activity thus moving in the field of tunneling, further development is sure to result. As tunnel construction is cheapened and its range of application widened, it will be more frequently applied.—*Engineering News Editorial.*

SAND-HOG DECOMPRESSION REGULATIONS

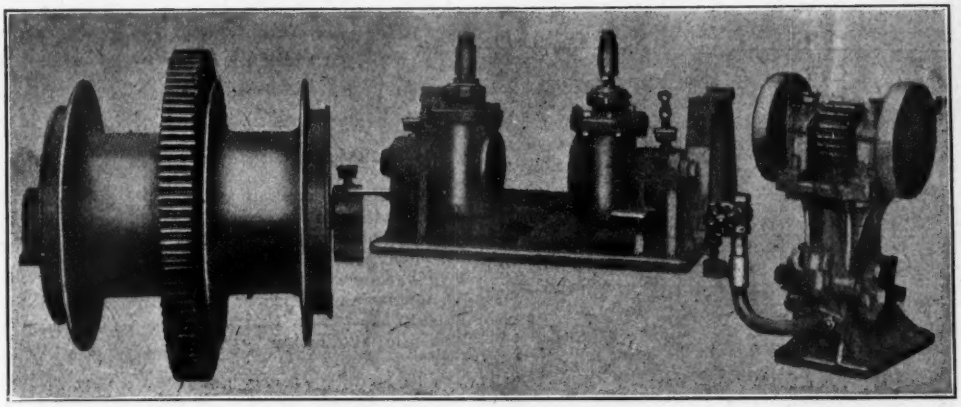
In the harbor siphon tunnels of the new intercepting-sewer system at Milwaukee, Wis., the Western Foundation Co. is carrying on compressed air work under unusually cautious rules. The following times are prescribed for decompression:

For Pressure (Lb.)	Time of Decompression (Min.)
20 to 24	16
25 to 30	20
31 to 36	24

The men are required to dry their clothes and drink hot coffee on coming out of the air, suitable facilities being provided. The two tunnels, worked from a joint shaft on Jones Island, are 52 ft. below river surface, and at present are carrying about 28 lb. air. They are in sand, which stands excellently under the effect of the air, so that open face work is done.

INFLAMMABLE LIMITS OF MIXTURES OF GASOLINE VAPOR AND AIR

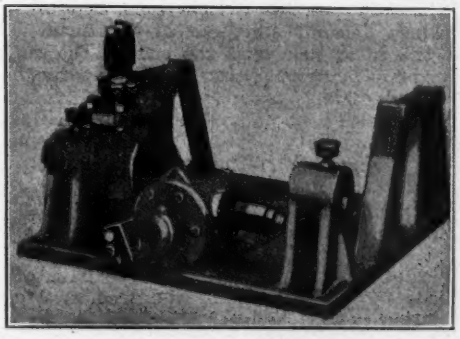
Using a 100 Cc. (6 cu. in.) Kempel explosion pipette, and igniting the mixtures from the top, there was obtained as the lower limit of complete inflammation a value lying between 1.9 and 2.0 per cent. of gasoline vapor. The upper limit under these conditions was found to be between 5.2 and 5.3 per cent. of gasoline vapor. The gasoline used had a specific gravity of 73 deg. Baumè. Under the same conditions, except ignition of the mixtures from the bottom, there was obtained a value lying between 1.5 and 1.6 per cent. of gasoline vapor for the low limit. With the same grade of gasoline, using a 2,800 Cc. (170 cu. in.) vessel and with ignition from the bottom, by means of an electric flash produced by pulling two wires apart through which a current of 7 ampères at 220 volts was flowing, there was obtained a value lying between 1.4 and 1.5 per cent. gasoline vapor. The high limit under these conditions lay between 6.0 and 6.4 per cent. of gasoline vapor. Appreciably different limits were not obtained with cleaners' naphtha.

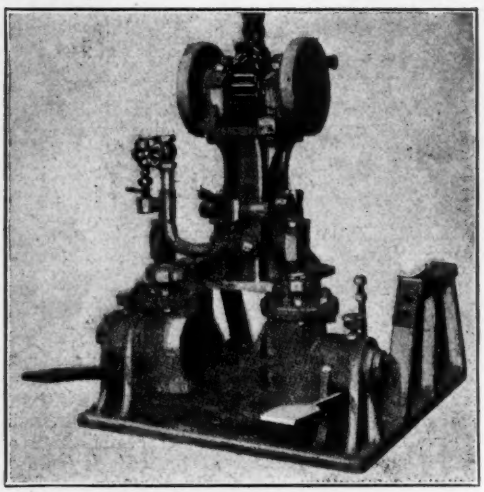


OSCILLATING CYLINDER COMPRESSED AIR HOISTING AND HAULAGE ENGINES

At a meeting of the National (British) Association of Colliery Engineers, North Staffordshire Branch, it was said that in connection with underground haulage, in coal mines, there has been for years a demand—amongst the smaller sizes—for a type of engine of the simplest possible construction, so that it could be handled by unskilled labor, and compact so that it could be moved from place to place with a minimum of difficulty. In view of this, a firm who made a specialty of underground conveyors had introduced an oscillating-cylinder type of engine in order to do away with expensive and complicated link motions. This form of engine, unless carefully designed, is liable to leakage at the port faces, and in order to counteract this tendency means are usually provided to tighten the working faces of the cylinders and air chamber against each other, with the natural result that, to prevent leakage, this degree of tightness is so great as to cause excessive wear and thus defeat its own object. In the engine described this objection has been overcome by carrying the cylinders in separate trunnions, and introducing a reversible valve between the cylinders which is composed of two independent parts kept up to the cylinder faces by means of the air pressure as in an ordinary slide valve.

The engine, as finally approved after test, is of the two-cylinder, double-acting, oscillating type, with the cylinders placed vertically at the front of the machine, the cylinder trunnions being carried on brackets on the bed and to the outside of the cylinders. The port faces of the cylinders face towards the centre of the engine, and between these faces is placed an air chamber, in which is carried the reversing valve, which also serves the purpose of supporting the crankshaft pedestals. The drumshaft is situated behind the engine, and is driven by means of a pinion and spur-wheel, but for endless and main-rope haulage, the drum is placed on the right-hand side. Each drum is fitted with a foot brake and hand-operated clutch. The engine is reversed by a handle placed in a central position in front of the cylinders. The two halves of the reversing valve are each scraped to an air-tight fit on the faces of the cylinders; and, as before mentioned, are kept up to their work by the pressure of the air. Therefore, once this joint is made air-tight, it will remain so for an indefinite period; and, as the exhaust takes place at the port face, a scavenging action is constantly present, which tends to keep the faces clean. This design of valve gives the shortest air ports it is possible to obtain, there-

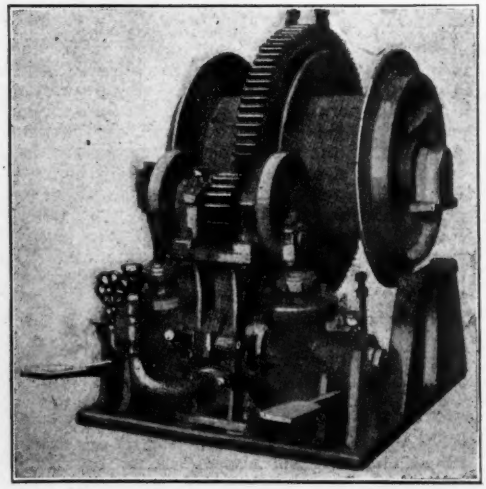




by consuming a minimum of air for a maximum of power; and, as the exhaust takes place through special ducts at the port face immediately into the atmosphere, no freezing can occur. For ease of erection or dismantling the drums are so designed that they can be removed by taking out four bolts, and the other units, such as crankshaft, cylinders and air-chamber, with equal ease.

The engines, which are made in several sizes, have also recently been adopted for driving coal conveyors, and can, of course, be adapted for a variety of other purposes.

The half tones, which through a second reproduction are far from satisfactory to the eye, will still serve to show the essential features of the machine.



AIR HAMMERS IN THE STONE TRADE

The International Cut Stone Contractors' and Quarrymen's Association of North America has been conducting a careful and diligent investigation of the charges made by the officers of the Journeymen Stone Cutters' Association that the air hammer is injurious to the health of the users. Some of the results of the inquiry are reported in the monthly leaflet issued by the association.

Instances have been found where some of the fingers on the hand guiding the hammer show poor circulation, and in freezing weather are more or less sensitive to the cold, but a case of paralysis of the arm, or, as charged, a man being driven insane or incapacitated in any way has not been discovered.

In New York City, where the air hammer is used in the stone industry probably more extensively than in any other city, a complaint has never been recorded against its use, and out of one hundred stonecutters interviewed on the subject during the past three weeks, ninety-seven favored the air hammer. In the Brooklyn Navy Yard the hammer is used very extensively for riveting and chipping, and there has never been a complaint registered against its use.

The structural iron workers use it in the erection of the steel and structural iron work, and the only complaint made by them was that they thought they should receive greater compensation when using the hammer, as they accomplished five times the work with the air hammer as they did by hand. At the works of the New York Ship Building Company at Camden, N. J., there is in use at the present time over one thousand air hammers, and there is no record of any such effect as complained of by the Stone Cutters' Union, and the employees have never made complaint against its use. At these works, as also at the Brooklyn Navy Yard, all riveting, chipping and calking is done with the air hammer, and the hammer used is very much heavier and more powerful than the hammer used by stonecutters and carvers.

The investigation, as far as it has progressed, has found, that where injury to the user

of the air hammer has occurred it has been caused by ignorance of its use. If there are any ill effects from the use of the air hammer it is caused by vibration, and the man using the hammer should be educated to hold the hammer in such a manner as to incur as little of the vibration as possible, and he should not try, or be permitted to do work with the air hammer for which it is not adapted.

Mr. James B. Gillie, of the South Dover Marble Company, a gentleman of the widest experience in the stone industry and one who has given a careful study to all the problems of the trade, writes that he has found that the use of the pneumatic hammer has been of great benefit to the trade and of no injury to the employees using the same, provided that the pneumatic hammer is used for the purpose it was intended to be used for, viz.: the finishing or lighter work done in our trade. Personally, I have had experience with the pneumatic hammer since it was first introduced into New York City, about the year 1901. I have seen it used on all kinds of stone used in the construction of buildings. I have personally interviewed men who have used the pneumatic hammer since it was first introduced into New York City, and they agree with me that it has been of great benefit to the trade and of no injury to the employees using it. The only complaint I have heard caused by the use of the hammer was that "sometimes in the winter the hands are cold," but when I asked the question, are the hands any colder when using the pneumatic hammer than they are when using the mallet and chisel, I was informed that there was practically no difference. Like all new inventions, there are apt to be abuses, caused by the improper use of the invention or by neglect of other implements that were used prior to the introduction of this tool. The fact that the pneumatic hammer and the necessary tools for the same are generally furnished by the employer, has given excuse to the employee to neglect the tools that they should furnish, and it is a very frequent sight to see an employee come to work with a mallet that has long outlived its usefulness, and a few tools that are but stumps and should be thrown into the scrap heap or made into plugs.

Another abuse of the pneumatic hammer is allowing apprentice boys to use it before they are thoroughly familiar with the use of the mallet, chisel, hammer, hammer points and pitching tools. The consequence will be that in a very short time new mechanics will be unable to use the tools that have always been deemed essential to the cutting of stone. The pneumatic hammer and tools as an adjunct to the old time honored tools of the stone cutting trade are a very decided improvement, but the fact should be brought forward that the old and the new must work together; if a mechanic is thoroughly acquainted with both, he will be a much better employee.

NOTES

An aeroplane was disabled by pigeons recently while making a flight in England. It appears that the machine, an army aeroplane, ran into a large flock of pigeons. The propeller struck a number of the birds, with the result that it was badly shattered. The aviator was forced to volplane to earth.

In 1892, vanadium was listed as the rarest metal and was valued at $4,792 a pound, or twenty times as much as a pound of gold. The discovery of the rich deposits in the Peruvian Andes, 16,200 feet above sea level, in 1905, caused the value of vanadium to drop rapidly; it is now sold at $3.50 a pound. It is being used, however, much more extensively than formerly, and new uses are being constantly found.

A large munitions manufacturer, when he found that over 5,000 cartridge cases had been spoiled, evolved the idea of making an ornamental beverage holder from a shrapnel shell fuse and cartridge case. The cartridge case contains a rack holding four glasses; inside the shell is a container which holds the beverage, and the fuse acts as a cover. The original shrapnel shell, loaded and ready for firing, sold for $15. This beverage holder, not "loaded" nor made to specifications, sells for $10.

The Standard Oil Company turned gas into the lines of its new compressor plant in Taft, Cal., on the famous McNee lease, on section 36, 31-23, and it was given its full initial tryout. The plant is one of the largest in the state used for the compression of gas of both high and low pressure. Combined with the plant which was built some months ago, 20,000,000 cubic feet of gas can be handled daily.

A boiler maker and his helper, as recently reported from Australia, entered the water tank of a locomotive through the manhole and, as the weather was cold, they took in a drum of live coals with them. Some hours later both were found lying dead at the bottom of the tank, killed by carbon monoxide. This was merely an unwitting repetition of the familiar French mode of suicide with a brazier of glowing charcoal.

Mushrooms will be grown in Pennsylvania coal mines by the Colin Mushroom Co., with headquarters at Arnold, Westmoreland County, a town on the bank of the Allegheny near Pittsburgh. There are about 20 old workings of the Valley Camp Coal Co., which have been exhausted of their coal supply and have not been used for many years, and these have been leased by the new company and will be provided with mushroom beds. About 25 men will be employed.

At a colliery in Rutherglen, Scotland, there was, until recently, an old "atmospheric" engine in use. The engine had been at work at the colliery for hoisting coal since it was erected in 1809. During that time, no part had been renewed, with the exception of two spur gears which were broken by accident. The engine was superseded by one of the modern construction a few months ago, and was then the oldest engine in use in Scotland, and the only one of the "atmospheric" type in use in Great Britain.

Lassen Peak, the most active and interesting volcano in the United States, is named for Peter Lassen, a pioneer who guided many an early settler to the sunny lands of the Sacramento. As Lassen never owned the mountain, in later years the possessive form of the name was dropped, and to correct a tendency to wander from well-established usage the United States Geographic Board, in its decision of October 9, 1915, officially recognized the fact that the name of the mountain was *Lassen Peak*, not Mount Lassen.

There are three different kinds of dynamite. The ordinary dynamite, which crystallises, or, as commonly said, freezes between 46 deg. Fah. and 52 deg. Fah.; the "low-freezing" dynamite, or ammonia dynamite, which does not freeze above 35 deg. Fah.; and another dynamite called non-freezing, which freezes at below 10 deg. Fah. Frozen dynamite is less sensitive to shock and consequently becomes less efficient. On the other hand, by vigorous friction, it may explode, and therefore, is dangerous. In cold weather, dynamite must be thawed before using.

Powdered coal in storage will ignite spontaneously more rapidly than before pulverization. When such powdered fuel contains 0.75 per cent. of moisture and 1 per cent. of sulphur, it will invariably fire within six days. If the moisture be increased to over 1 per cent. and the sulphur to 4 or 5 per cent., spontaneous combustion may occur within 24 hr. Probably the temperature at which powdered coal is delivered to the storage bin and the sulphur content of the coal influence the rate of spontaneous combustion more markedly than does the percentage of moisture.

Live fish are reported to have been found in the bottom of a Transvaal gold mine, in a vertical shaft 3,800 ft. deep. They were barbel, from 6 in. to 12 in. long, and up to three-quarters of a pound in weight. They must have been merely spawn when they fell, says a correspondent of the *Fishing Gazette*. In exceptionally dry weather, adds the writer, small bull-frogs have been seen to distend themselves and deliberately jump down the shaft, apparently in search of water. How they ever reached the bottom alive is a mystery.

The brown oak, which is famous in England and sells for exorbitant prices in American furniture factories, is justly famous for its beauty. No wood ranks higher and few cost more. Its rich but subdued color is justly praised by those who appreciate rare colors. But why is it brown? An English scientist has discovered that the tone is due to fungus which has penetrated the tree from bark to heart and filled every fiber. The fungus does not seem to promote decay or in any way lessen the strength or affect the durability of the wood.

The Brasher air breakwater, which is to protect the Standard Oil pier at El Segundo, California, described in *Compressed Air Mag-*

azine, May, 1916, page 7980, has recently been completed at a cost of $10,000 for the 1,700 ft. of pipe and its installation. The pipe is 4 in. with ¼-in. perforations 6 in. apart. An air compressing plant supplies the air to the pipes at the pressure determined by the depth of submergence. This air rising through the water gives it a certain elasticity and is expected to calm the surface sufficiently for safely loading and unloading the tankers.

Through the use of a pulmotor, operated by M. E. Gregson of the distribution department of the New York Edison Co., the life of a four-hour old infant was saved recently, says the Edison Weekly. Shortly after nine o'clock in the morning, Dr. J. Kramer phoned to The New York Edison Co. for assistance, stating that a baby boy's lungs had collapsed. Mr. Gregson received the call at 9.42 and made a grab for the pulmotor and oxygen tanks. By 11.50, after two hours work, the infant became conscious and a moment later began to cry in a decidedly boy-like manner.

The mining stock of the highest share value in the world is that of the Union Sulphur Company, producer of four-fifths of the world's sulphur. There are only 2,000 shares, but they have an appraised value of $12,003 per share or a total at this rate of $24,006,000, but at this, or any other, price it is impossible to buy a share. Several years ago a few shares of the stock brought $19,400 per share. On Jan. 1, 1916, the company had undivided profits of $6,360,688, equal to $3,180 per share on its outstanding stock. At the same time the company carried a stock of 1,127,596 tons of sulphur. Assuming an average of $22 a ton this would be worth $24,907,112; but it is understood that sulphur has since advanced to about $28 a ton, giving this tonnage a total value of $31,572,688. Assuming an average cost of $10 per ton and an average profit of $18, there was a stockholders equity of close to $10,148 per share, or a total, including undivided profits, of over $13,000 per share. Dividends are now being paid at the rate of 2250% annually.

The Panama Canal channel through Culebra Cut, according to the Panama Canal *Record,* is now in better condition than ever before. The cut which has been dredged through the slides has a minimum depth of 33 ft. and the least width of a channel of 30 ft. depth is 180 ft. at the point opposite the rock known as Gibraltar. This rock projects into the channel about 110 ft. and extends along the channel about 200 ft. It has been blasted away until it now rises only about 30 ft. above the water. The dredges "Corozal" and "Paraiso" are at work on the removal of this rock and are dredging behind it to prevent its being pushed forward.

A new process of supplying pure air to submarines has been discovered. The inventor, William G. Bond, of Wilmington, Del., recently demonstrated the use of his apparatus by remaining in a test chamber 3 feet by 4 feet by 6 feet for seven hours with only the air furnished by his device. The air is purified by a chemical reaction between carbon dioxide and certain solutions exposed to the atmosphere of the chamber. The carbon is absorbed and the oxygen liberated. The test room used was entirely surrounded by water. Mr. Bond entered the tank clad in a bathing suit and supplied with reading matter, food, air-testing apparatus and the chemicals. He kept in communication with the observers on the outside by means of a telephone.

A project for the construction of a tunnel under the Bosporus is being discussed at Constantinople. Engineers have worked out detailed plans showing that the project is feasible and financially profitable, while its strategic importance is obvious.

The quantity of artificial gas—oil and water gas and coal gas made at retorts and by-product coke ovens—marketed and sold in 1915, was 266,204,248,000 cubic feet, valued at $173,832,132.

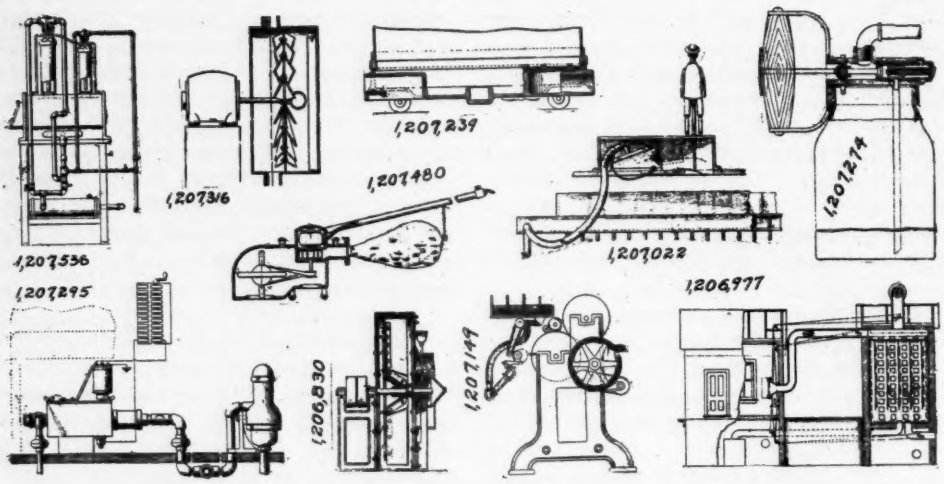
LATEST U. S. PATENTS

Full specifications and drawings of any patent may be obtained by sending five cents (not stamps) to the Commissioner of Patents, Washington, D. C.

DECEMBER 5

1,206,828. PROCESS OF DRYING THE COMPOSITION HEADS OF MATCHES. WILLIAM A. FAIRBURN, Short Hills, N. J.

1. In the manufacture of matches upon a continuous match machine, a process which consists in applying to the match splints composition heads or bulbs containing an oxidizing agent as an ingredient; and then transporting the splints



PNEUMATIC PATENTS DECEMBER 5.

thus treated through a series of drying zones, wherein they are subjected first to air currents of successively increasing temperatures and then to air currents of successively decreasing temperatures.

1,206,830. CENTER-SUCTION FAN. FRANKLIN A. FLECK, Middletown, Pa.

1,206,977. PROCESS OF CONTROLLING THE HUMIDITY OF THE ATMOSPHERE. FRANK BATTER, Linnton, Oreg.

1,207,022. DANCING TOY. CLIFFORD H. GREEN, Grand Rapids, Mich.

1,207,149. PNEUMATIC PRESS - FEEDING MEANS. JAMES DUVALL, Camas, Wash.

1,207,165. AIR-COMPRESSOR. CHESTER A. HERLE, Rochester, N. Y.

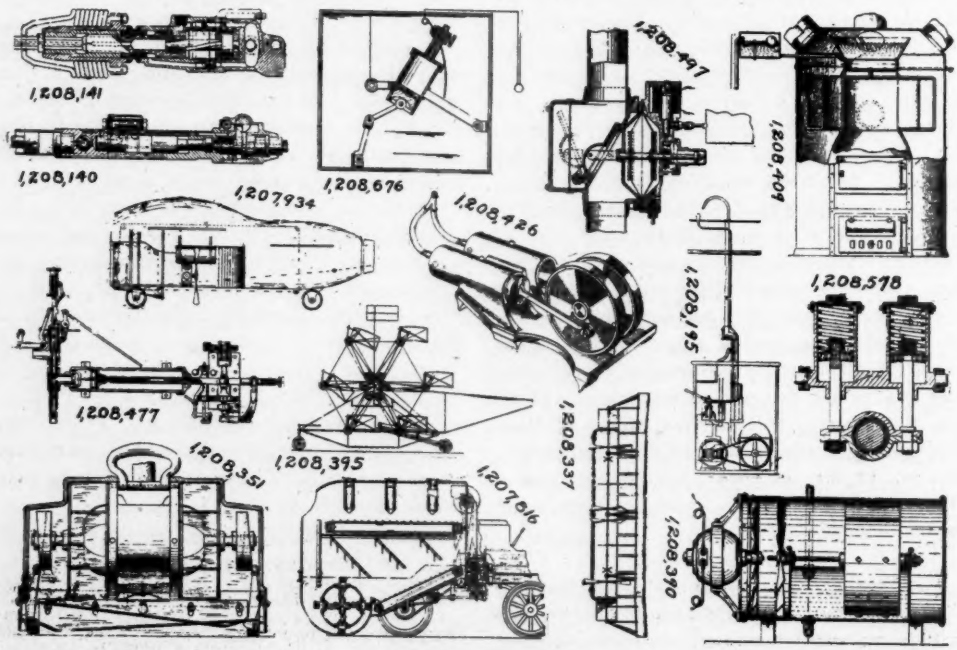
1,207,239. VACUUM - CLEANER MUFFLER. JOSEPH H. TEMPLIN, Philadelphia, Pa.

1,207,274. SPRAYING OR ATOMIZING DEVICE. WILLIAM C. CARTER, St. Louis, Mo.

1,207,295. MEANS FOR CONTROLLING ELECTRICALLY-PROPELLED VEHICLES. OSCAR JOHNSON, Chicago, Ill.

1,207,316. AIR-CIRCULATING APPARATUS. MOSBY MONTAGUE, Christiansburg, Va.

1,207,480. COMBINED SUCTION - CLEANER, BLOWER, AND POLISHING DEVICE. BENJAMIN F. BLAKE, Marion, Ohio.



PNEUMATIC PATENTS DECEMBER 12.

1,207,536. MEANS FOR CONTROLLING TEMPERATURES. HARRY E. GILBERT, Conshohocken, Pa.

1,207,568. PNEUMATIC ACTION. FREDERICK A. LANDGREN, Sycamore, Ill.

DECEMBER 12

1,207,772. PNEUMATIC CUSHION. IRVING A. LAKE, New York, N. Y.

1,207,813-4. METHOD FOR PRESERVING TENNIS-BALLS OR OTHER OBJECTS CONTAINING FLUID UNDER PRESSURE. FRANK W. STOCKTON, Chicago, Ill.

1,207,816. STREET - SWEEPER. CARL G. THOMPSON, Sullivan, Ind.

1,207,893. COMPRESSION REFRIGERATING-MACHINE. CARL C. GERLACH, Cleveland, Ohio.

1,207,934. AIRSHIP. AUGUSTUS PETER KOCH, New York, N. Y.

1,208,140. FLUID-OPERATED TOOL. LOUIS W. GREVE, Cleveland, Ohio.

1,208,141. FLUID - OPERATED DRILLING-MACHINE. LOUIS W. GREVE, Cleveland, Ohio.

1,208,337. AIRSHIP. HERMAN LEINWEBER, Chicago, Ill.; Curt Leinweber and Fred H. Leinweber executors of said Herman Leinweber, deceased.

1,208,351. VACUUM FLOOR-CLEANER. ALBERT E. MOORHEAD, San Francisco, Cal.

1,208,389. FIRE - ALARM OR SIGNALING SYSTEM. JAMES M. SEYMOUR, Jr., Newark, N. J.

1,208,390. COOLING AND HUMIDIFYING APPARATUS. JAMES M. SEYMOUR, Jr., Newark, N. J.

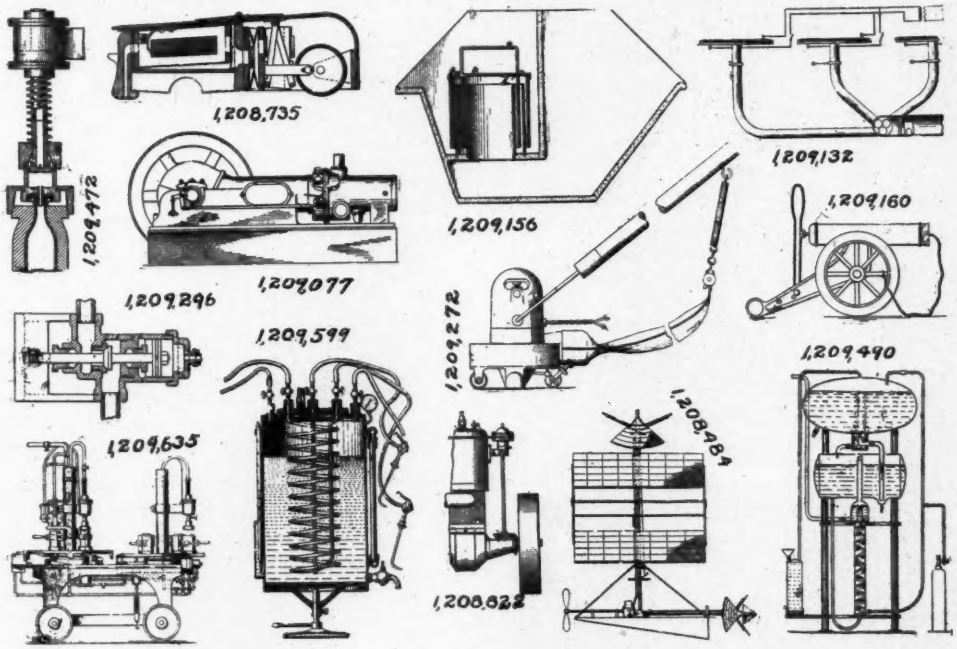
1,208,395. FLYING-MACHINE. RUTER W. SPRINGER, U. S. Army.

1,208,409. HUMIDIFIER. DEWITT VAN EVERA, Chicago, Ill.

1,208,426. AIR-COMPRESSING PUMP. WILLIAM JOSEPH WHITE and WILLIAM FRANK NEAL, Birmingham, Ala.

1,208,475. ATOMIZER. RAY HUGH CALLAN, Trenton, Mo.

1,208,477. PNEUMATIC TYPE-WRITER CARRIAGE. GEORGE E. CALLAWAY, De Soto parish, La.



PNEUMATIC PATENTS DECEMBER 19.

1,208,165. VACUUM CLEANING-TOOL. GORDON E. KENT, Rome, N. Y.

1,208,195. PNEUMATIC - DESPATCH - TUBE APPARATUS. ALBERT W. PEARSALL, Lowell, Mass.

1,208,325. DEVICE FOR CONDENSING AND VACUUM-PRODUCING. EMIL JOSSE, Berlin-Lankwitz, and WILHELM GENSECKE, Berlin, Germany.

1. In a condensing plant the combination of a surface condenser, cooling means for said condenser, a water circulating system independent of the cooling means, pressure means included in said system to maintain the circulation thereof, a jet actuated by the pressure means and arranged to withdraw air and condensate simultaneously from said condenser through a single discharge opening and an open tank in said water circulating system whereby air is permitted to pass off and a surface of evaporation is provided.

1,208,497. PNEUMATIC-DESPATCH APPARATUS. JAMES T. COWLEY, Minot, Mass.

1,208,578. AIR - CUSHION FOR AUTOMOBILES. ROMANUS KRAUSE, Belhaven, N. C.

1,208,676. ELECTRIC PNEUMATIC TIME-SWITCH. ORVALL SMILEY and EARL C. APPLEGATE, Indianapolis, and GUY R. BENNETT, Fort Wayne, Ind.

DECEMBER 19

1,208,735. VACUUM-CLEANER. HOMER L. BOYLE, Lansing, Mich.

1,208,822. LOCKING MEANS FOR INTERNAL-COMBUSTION MOTORS. CASIN W. OBERT, Brooklyn, N. Y.

1,208,984. FLYING-MACHINE. JAMES KREITER, Fredericksburg, Ohio.

1,209,077. OPERATING MEANS FOR COMPRESSOR-VALVES. FRANK M. TITUS and DELMAR B. SCHWAB, Bradford, Pa.

1,209,132. MACHINE FOR SUBJECTING AIR TO VIOLET AND ULTRA-VIOLET RAYS. NOAH W. DAVIS, Des Moines, Iowa.

1,209,156. PNEUMATIC FLUME-GATE. PERRY L. HEDRICK, El Centro, Cal.

1,209,160. TOY CANNON. DAVID HEYMAN and THOMAS RAYMOND ARDEN, Brooklyn, N. Y.

1,209,223-4. DIVING-DRESS. HERMANN STELZNER, Lubeck, Germany.

1,209,272. SUCTION-CLEANER. FREDERICK A. ENGLISH, Chicago, Ill.

1,209,296. AUTOMATIC TRAIN - STOPPING DEVICE. WILLIAM S. HOLDSHIP and FREDERICK L. JONES, Montreal, Quebec, Canada.

1,209,472. BLOW - HEAD FOR BOTTLE-BLOWING MACHINES. JOHN J. MEYER, Jr., Glenshaw, Pa.

1,209,490. APPARATUS FOR IMPREGNATING LIQUIDS WITH CARBONIC ACID OR OTHER GASES. ANDERS ANDERSEN PINDSTOFTE, Copenhagen, Denmark.

1,209,930. AIR OR GAS COMPRESSOR. TYRUS DOUGLAS BERKELEY, Ruabon, Wales.

1,209,944. PNEUMATIC PUMP. CHARLES A. DE RIGNE, Los Angeles, Cal.

1,209,954. MACHINE FOR EXHAUSTING AIR FROM PRESERVING VESSELS. WILLIAM B. FENN, Columbus, Ohio.

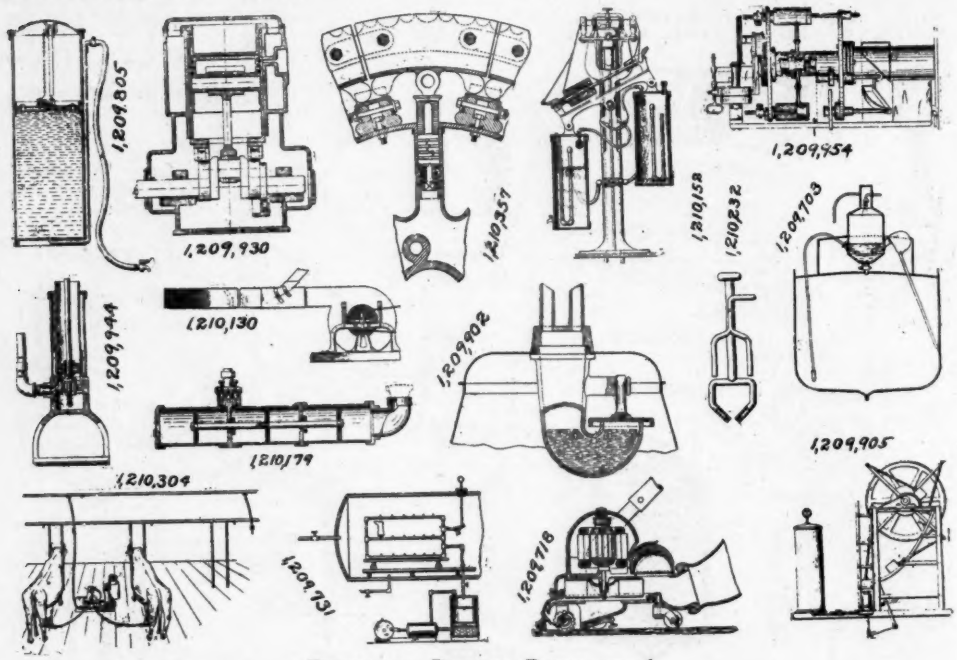
1,209,965. AUTOMATIC AIR - LINE COUPLING. FLAVIOUS J. HOLLCROFT, Jenks, Okla.

1,210,030. BLOWER SYSTEM. KARL BAUMANN, Chorlton cum Hardy, England.

1. In combination, a plurality of prime movers operating in parallel and means for insuring the equality of the fractional outputs of the several prime movers, said means comprising a plurality of regulators and an equalizing pipe connecting the inlets of said prime movers.

1,210,130. PNEUMATIC CONVEYER. JAMES ALVIN WORSHAM, Maroa, Ill.

1,210,152. PUMP. GEORGE DORFFEL, Oakland Cal.



PNEUMATIC PATENTS DECEMBER 26.

1,209,599. HOT WATER AND AIR TANK FOR DENTISTS' USE. HARRY W. LE FEVRE, Denver, Colo.

1,209,635. GLASS-BLOWING MACHINE. LORENZO WOLFORD, Alexandria, Va.

DECEMBER 26

1,209,703. ASH - EJECTING MECHANISM. WILHELM HARTMANN, Offenbach-on-the-Main, Germany.

1,209,718-22. VACUUM CLEANING - MACHINE. JAMES B. KIRBY, Cleveland, Ohio.

1,209,726. RECOIL-PAD. PAUL J. KRUEGER, Blue Island, Ill.

1,209,731. EXHAUSTING APPARATUS FOR VULCANIZING. CLIFFORD LEE, Naugatuck, Conn.

1,209,805. GREASE-GUN. HANS M. BOE, Minneapolis, Minn.

1,209,851. LUBRICATING SYSTEM. FRITZ KOCH, St. Paul, Minn.

1,209,902. MILKING MACHINERY. HECTOR STEWART, Galt, Ontario, Canada.

1,209,905. AIR-COMPRESSOR. WARRINGTON W. SWETLAND, Los Angeles, Cal.

1,210,179. GREASE-GUN. WILLIAM H. LEWIS, Los Angeles, Cal.

2. A grease gun having a lubricant moving piston, means for applying fluid pressure to the device for moving the piston in one direction for drawing a lubricant into the gun and in the other direction for forcing said lubricant out of the gun.

1,210,232. SPRAY-PRODUCER OR ATOMIZER FOR LIQUIDS. DAVID HIBBERT THOMAS, Morriston, Wales, ARTHUR DOUGLAS BERK, London, England, and FREDERICK JOHN MORGAN, Swansea, Wales.

1,210,239. PNEUMATIC PIANO - PLAYER. EUGENE C. WAMELINK, Cleveland, Ohio.

1,210,246. AUTOMATIC TRAIN - STOP CHARLES W. WILSON, Berea, Ohio.

1,210,299. PNEUMATIC OR STEAM DRILL. RICHARD CLAYTON FRASER, Central City, Colo.

1,210,304. MILKING-MACHINE. JAMES N. GILMAN, Berkeley, Cal.

1,210,357. PNEUMATIC-WHEEL. FRANCESCO PERSONE, Nardo, Italy.

1,210,387. AIR-PUMP. CHARLES CAREY MANKER, Ogden, Utah.